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AMERICAN JOURNAL *OF* OPHTHALMOLOGY

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FIG. 1. (JULIANELLE, MORRIS AND HARRISON).
A TYPICAL CORNEAL REACTION DURING EARLY DEVELOPMENT OF CLOUDING AND VASCULARIZATION. THE REACTION OCCURRED IN A RABBIT FOLLOWING INOCULATIONS BY SCARIFICATION OF THE CORNEA AND INSTILLATION OF STAPH. AUREUS. PANNUS TENUIS OF HUMAN TRACHOMA IS SUGGESTED.

FIG. 2. (JULIANELLE, MORRIS AND HARRISON).
A TYPICAL CORNEAL REACTION IN A LATER STAGE OF CLOUDING AND VASCULARIZATION. FOLLOWING REPEATED SCARIFICATION AND INSTILLATION OF STAPH. AUREUS. AT THIS STAGE, THE VASCULARIZATION SUGGESTS PANNUS CRASSUS OF HUMAN TRACHOMA.

FIG. 3. (JULIANELLE, MORRIS AND HARRISON).
CORNEAL REACTION FOLLOWING A SINGLE DIRECT INJECTION OF THE NUCLEOPROTEIN OF STAPH. AUREUS. THIS ILLUSTRATES THE PANNUS OF IRRITATION. THERE WILL BE NOTED AS BROUGHT OUT IN THE TEXT A DIFFERENCE IN THE VASCULARITY AND THE FORMATION OF A "SALMON PATCH."

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 16 NOVEMBER, 1933 NUMBER 11

SOME REMARKS ON THE ETIOLOGY OF CATARACTS*

Slitlamp Studies

ARTHUR J. BEDELL, M.D.
ALBANY, N.Y.

Dilatation of the pupil is imperative for a complete study of the lens. The writer does not consider the cataract associated with diabetes to be a distinctive type of cataract. He does not regard the various forms of cataract as distinct pathogenically. Only in cases of developmental or growth opacities and those due to gross injury can the causes be tabulated and associated with the distinctive lens picture. Read before the Association for Research in Ophthalmology, in Milwaukee, May 10, 1933.

My remarks on the etiology of cataracts as ascertained by slitlamp studies, will be devoted to the exposition of those developing either from congenital or acquired causes, subdividing the latter into those which result from age or metabolic disturbances and trauma. All observers agree that by means of the slitlamp an accurate determination can be made of the age of the patient at the time a given lens opacity was formed and that much valuable information can be secured as to the duration of the cataract as well as the character of its growth, whether it is stationary or progressive and, if the latter, whether its advance will be rapid or slow. Everyone familiar with the use of the instrument understands the methods by which opacities are accurately located within the lens. Other collaborators in this symposium will discuss the particular formation of cataracts resulting from specific causes.

This presentation is limited to the photographic demonstration of the commonest types as well as some of the rare ones. We follow the simplified method of considering a cataract as of embryonic, fetal, infantile, adult, cortical, or capsular origin.

It has been estimated that the embryonic nucleus is formed from the first to the third month and measures about 3 mm. in diameter. We shall use one drawing and several photographs made from actual cases to show that when there is an opacity in this layer it is in the exact center of the lens and consists of fine granular dots. The photographs are not clear because in taking the pictures the light reflection from the anterior surface of the lens is so intense that it tends to obscure the lesion. Embryonic cataracts do not interfere with vision and do not show any tendency to enlarge.

The fetal nucleus is laid down from the third to the eighth intrauterine month and is probably about 4 to 5.5 mm. in size. On its anterior surface there is an upright "Y" and on its posterior an inverted "Y". This configuration may be carried through many layers of the lens sometimes participating in this configuration. These Y's may be very faintly demarcated by a few minute white spots or the opacities may be so dense that they can be readily seen even by oblique illumination. The characteristic Y persists during the life of the individual and is recognizable even during the formation of a progressive cataract. The diagnostic feature, therefore, of a fetal cataract is the anterior and posterior Y-shaped cloud. Widened subcapsular suture lines are sometimes mistaken for a Y.

The infantile layers are those which develop from the time of birth to puberty and, therefore, the size of the infantile nucleus, 5.5 to 8.5 mm., depends

* Fifty photographs were used to illustrate the article.

upon the age of the patient when the examination is made or when the opacity in it matured. Obviously these changes can only be recognized by stereoscopic examination. Infantile cataract can be most easily photographed when opacities in the adjacent layers accentuate the refracting surfaces. The relative position of this infantile nucleus is best seen when there are lamellar opacities. These are divided into the individual hook or so-called rider, a ring of riders, a white arc involving many layers, or a complete zonular cataract. Isolated riders are sometimes confused with the radiating lines of a progressive change. Cataracts of the infantile nucleus are stationary.

The adult layer is that which is formed from puberty to adult life. It is of unequal thickness but on both its anterior and posterior surfaces there are definite markings which are so well depicted by Vogt and so difficult to photograph that I shall exhibit one of his illustrations from his atlas to demonstrate this surface contour. These adult nuclear reflections have not only been seen by all ophthalmologists but are so thoroughly understood that no further comment will be made at this time.

The lens grows throughout life and new fibers are constantly added to the adult nucleus to form the cortical layers. Opacities in these regions often lie directly beneath the lens capsule and assume several forms, the commonest of which are the flat, homogeneous, white masses and the spire or triangle with apex pointing to the pupillary area.

The site of these opacities is illustrated in a diagram which shows the necessity of dilating the pupil before a study of the lens is considered complete. With the small pupil the central opacity and a few fibers in the infantile layer are seen. After partial dilatation additional clouded fibers are found in the adult layer and when the pupil is widely dilated those in the cortex also become evident. Surely, therefore, no one should ever describe the condition of the lens without first dilating the pupil.

In addition to the lens mutations, we have a great variety of capsular alterations. The appearance of some of these is most confusing. One change in the anterior capsule is an isolated opacity which remains stationary throughout life. To it pupillary-membrane threads can be traced or a meshwork of vessels remain adherent. Frequently minute pigmented dots are concentrically arranged on the surface of the white capsular spot. Often there are reduplications of the opacity so that inspection discloses a white, spool-shaped cataract involving many layers of the lens. A capsular cataract may be present with a variety of lens opacities including minute white dots in the infantile nucleus. The capsule consists of at least two layers which are demonstrated photographically in certain middle-aged or senile patients. One type of split or exfoliated capsule, characterized by furled white edges and a granular cell-like surface, is frequently found in those suffering from glaucoma. It is also seen in eyes without increased tension.

There are several more or less clearly differentiated ways in which so-called senile cataracts form and progress. In one, the lower nasal side of the adult nucleus is first attacked. Spirelike projections are formed which increase in depth and surface extension into both the anterior and posterior adult layers until they produce a thick, white sheet.

In another type, and this is probably the commonest of all, the sector lines of the lens are widened to form water clefts. These clefts are transparent and in the beginning the edges are distinguished only with considerable difficulty from the surrounding lens structure. As the process advances the clefts become filled with small, spherical masses called globules or vacuoles. The individual clefts widen, several coalesce, and their margins become gray. In this way opacities develop which at times are regular and conform to the sector arrangement but often they are without characteristic pattern. The advancement is by no means uniform for sometimes, even after many years, there is only a very slight change. As these white-bordered clefts increase in num-

ber and size they become more evident and by contrast with the clear adjacent lens they are sometimes so dense that they can be seen with the naked eye. The entire lens eventually becomes opaque but the sutures may remain as permanent visible features of the cataract. Lens segments may be granular, white, glistening, or even pearly in appearance.

Another type of cataract commences with a peripheral crown of finger-like knobs which project into the adult layer. These coronar cataracts grow by an enlargement in the outer ring and a gradual involvement of the cortex, frequently showing a disproportionate advance in the posterior cortical layers.

One form of progressive senile cataract is that which begins in the nucleus of the lens. This is slow in formation and more difficult to photograph.

Still another originates in the cortex where waves and bizarre figures of interlacing opaque lines develop.

When most of the lens is opaque it is with great difficulty that we can determine just where the cataract started. Most cases, however, lend themselves to a critical analysis, which usually reveals the site of initial involvement.

If the opacities are close to the capsule they may be thin and, as has been well shown and beautifully pictured by Vogt, they reflect various colors, blue and green dominating. This was particularly marked in a case where the small opacities were over the Y.

The posterior cortical changes are of very great diagnostic significance. They are recognized by their depth and color, for almost all of them reflect either a brown, golden, or iridescent sheen. Frequently they are geometric in design. Some show suture-line reduplications with branches that include the cortex and other parts of the lens. When they are saucer-shaped, containing clear areas which give the impression of punched out spots, they indicate progressive lens changes. When they consist mainly of various-sized vacuoles, they are indicative of intraocular disease such as retinitis pigmentosa. When the rays of the star consist of lens fibers radiating from the suture lines, injury must be considered as the probable cause. This last opacity is a thin uniform layer and may increase, lessen, or even disappear.

The only reason that we introduce the general subject of traumatic cataract is to draw attention to the changes that take place in a penetrating wound of the eye and those that follow the slow absorption of fluid from other causes. The accentuation of the individual lens segments is very beautifully shown following certain injuries. After a penetrating wound, an isolated clouding of the capsule and the immediately contiguous cortex is demonstrable. A frequently unrecognized type of traumatic cataract is that in which leaf-shaped opacities are found beneath the anterior or posterior capsule. The amount of lens damage depends upon the size of the opening of the capsule, the amount of compression of the lens and whether it becomes general or remains local. The changes, if confined to the anterior and posterior cortex are either widespread or isolated. A diagram may be of particular value at this point to show the changes beneath the anterior capsule following glaucoma and in the posterior cortex following intraocular disease.

Deformed or dislocated lenses are of interest. Certain malformations including notch of lens are worthy of attention and the dislocations including the group where we have subcapsular, threadlike skeins or true sector opacities must be considered as well as the complete dislocation of the lens either forward where we can see the absorption of the mass or posteriorily where secondary changes complicate its degeneration.

It is important to understand the two methods by which the cataractous lens is absorbed. One is by the liquefaction of the cortex so well known as the morgagnian cataract. We can trace the swelling of the lens, the absorption of some of the fibers, the formation of fluid within the capsular sac, and the floating nucleus.

The other kind of lens destruction seems to be a true shrinking or desiccation. The lens flattens, the opacity in-

creases in density, the cortex becomes a homogeneous mass, and faint, white nodules appear just beneath the anterior portion of the capsule. These increase in number and, as the lens fibers shrivel, various figures are formed by these white, often calcified, masses. Finally nothing is left but a wrinkled, puckered, capsular membrane with practically no cortex.

Some observers say that by means of a slitlamp examination of the lens they can make the diagnosis of the probable etiological factor involved in the production of a given cataract. This is debatable. The more lenses I see and the more diabetics I examine, the less convinced I am that there is a definite cataract caused only by diabetes. The medico-legal importance of cause is so great that all who claim to be ophthalmologists must in fairness to the plaintiff and the defendent be proficient not only in the use of the instrument but also cognizant of the innumerable changes that are brought about by age. Too often a classical senile cataract has been called a traumatic one simply because sympathy for the patient or some other motive has swayed the examiner's judgment. In some cases ignorance plays the major rôle in the pervasion of justice.

In conclusion, the slitlamp examination of the lens is a technical procedure.

The one who masters the technic and who studies each case with diligence and understanding can learn much regarding cataracts.

The histological structure and developmental character of the lens must be known if an accurate diagnosis is to be made.

The simplest and most comprehensive scheme for the classification of cataracts is that which considers the embryonic, fetal, infantile and adult nuclei, the cortex, and the capsule as integral but separable parts of the lens.

As yet we are not able, except in developmental or growth opacities and the gross injuries, to tabulate causes and correlate them with distinctive lens pictures.

Slitlamp investigations when properly combined with physical and chemical examinations and photographic records will certainly prove most valuable to the coming generations.

344 State Street.

Discussion: DR. THOMAS B. HOLLOWAY (Philadelphia, Pa.): I would like to ask Dr. Bedell whether he has had an opportunity of studying a series of Mongolians and what he has noted in regard to the increasing frequency in the development of the opacities with the age of the individual.

DR. BEDELL: I recall having seen eleven Mongolians. Most of them were temperamentally unfit for slitlamp examination. They had marked blepharitis and the conjunctiva was congested most of the time. It was, therefore, very difficult for them to keep their eyes open when placed before the instrument. I would rather not make any statement as to the progress of cataracts in these patients. Only two cases have been under observation more than seven years and both came when they were six years of age.

DR. EMORY HILL (Richmond, Va.): Will Dr. Bedell explain again the difference between these riders and dashes?

DR. BEDELL: I could do that much better with a stereoscopic picture. A rider is an isolated opaque hook opacity involving both the anterior and posterior edge of a sector of the lens.

The dash-shaped opacity involves only one layer and is very easily distinguished from the rider.

DR. EDWARD STIEREN (Pittsburgh, Pa.): It has been claimed by some that splitting of the capsule is indicative of glassblower's cataract. Is that your experience?

DR. BEDELL: I have not seen it in a single glassblower. Most, but not all, of my cases of split capsule had glaucoma. The last three patients whom I saw with this condition had no glaucoma and had never been exposed to extreme heat or electric flashes. I should like to go into this more thoroughly for I am convinced that our textbooks are writ-

ten and medico-legal opinions rendered on many incorrect assumptions.

DR. WILLIAM W. PEARSON (Des Moines, Iowa): Do I understand you do not believe diabetes plays any rôle in the formation of cataract?

DR. BEDELL: No, sir, you did not hear me correctly. I said I did not believe the cataract that came in the diabetic was a distinctive type of cataract.

DR. PEARSON: Doctor, in compensation cases, how much value do you place on finding evidence of cataract in the uninjured eye? When the cataract has developed in the injured or supposed to be injured eye, our opinion is that it was there originally. How much influence has it?

DR. BEDELL: It is absolutely necessary to know the exact position of the lens opacity. This is primary and without this knowledge I believe we should not render an opinion. If we find that the opacity is in a layer that was laid down years before the alleged accident, I think we have a right to disregard the accident as a causative factor.

DR. PEARSON: In any of these cases, however, the patient is kept under observation over a period of months and if the two are developing equally in the two eyes, that in itself. . . .

DR. BEDELL: (Interrupting): That is very strong presumptive evidence that it is not traumatic, but often you must render your opinion immediately.

DR. PEARSON: Our Commissioner, however, in a case of this kind where there is any question, delays final settlement for an indefinite time.

DR. BEDELL: The reason commissioners and judges are confused is that the ones in whom they place confidence are not certain of their statements.

DR. GEORGE E. DE SCHWEINITZ (Philadelphia, Pa.): In your observations, have you found a rather unusual frequency of so-called cerulean punctate cataract in association with conical cornea?

DR. BEDELL: No, sir, I haven't. I don't say that it is not more common but that I have not found it so in the many cases I have examined.

DR. HOLLOWAY: I should like to ask one other question. Occasionally you will find in the posterior part of the lens an annular punctate opacity that has all the appearance of the Vossius ring cataract anteriorly. What in your experience has been the progress of these cases?

DR. BEDELL: Those I have seen have shown practically no change over a period of many years. I should, of course, to amplify your general statement, ask you to remember that we may have white spots or minute pinpoint dots scattered all through the lens. I have a photograph with me which illustrates this.

DR. ARTHUR M. YUDKIN (New Haven, Conn.): What is the character of the particular change you have noted in retinitis pigmentosa?

DR. BEDELL: The first lens change in the cases of retinitis pigmentosa we have observed has been a globular or, as some term it, vacuole formation in the posterior cortical layer. These globules tend to form a more or less stellate mass which increases in size. New globules develop in all portions of the posterior cortex. As the cataract progresses, similar changes appear beneath the anterior portion of the capsule and gradually the entire lens becomes opaque.

DR. WILDER: Do you feel, Dr. Bedell, we can place very much reliance upon the significance of these various forms? At least it is interesting to speculate as to how much we are justified in giving the patient a more or less favorable prognosis. We have the statement that this particular form of cataract is not likely to increase, it may be arrested completely. I often hear it stated that of the various cataracts, incipient and other, that appear to the busy practitioner, probably more than half of them are either arrested or never reach a stage where operation is necessary. I would like to have your view in regard to classification of these various forms of opacities and what we are entitled to say in prognosis.

DR. BEDELL: The cataract which progresses most slowly is the one characterized by the formation of opacities in the inferior nasal sector of the anterior adult layer. These may be spire-

shaped and almost homogeneous, or bluish-gray, like the cleavage fissure in clear ice. The next slowest form seems to be the senile nuclear cataract which consists of very small opacities and is difficult to photograph. It is easily recognized with the ophthalmoscope but less clearly with the slitlamp.

Widespread water-cleft formation is probably the most rapid type. A traumatic cataract may present massive swelling of the broken or distended lens fibers or show the characteristic posterior cortical change of sector branches with fine feathery extensions. This later type cataract may disappear.

When globules appear in layers or clusters the advance is usually rapid.

Gross gray or bluish-gray opacities have never in my experience been influenced by any form of treatment. I have one patient who has been under observation for forty-six years. Her lens is about the same and her vision unchanged but I am sure you will all agree that the progress of a cataract cannot be determined by visual tests.

DR. WOODS: Have you ever seen any form of cataract influenced by treatment?

DR. BEDELL: I have not.

DR. WILDER: Is it your opinion that there is no difference in the pathogenicity in these various forms?

DR. BEDELL: Yes. At the present time I believe the lens change is the same but activated by different agents.

DR. WILDER: The question was whether we were justified in thinking these various forms are in some way or other distinct pathogenically.

DR. BEDELL: I don't believe they are.

DR. HILL: What about the brownish saucer-shaped posterior type?

DR. BEDELL: All posterior cortical cataracts show iridescence. The brownish saucer-shaped ones consist of a single layer of posterior cortex which sometimes grow rapidly and always cause considerable visual disturbance.

THE POSSIBLE INFLUENCE OF IMMUNOLOGICAL FACTORS IN THE PRODUCTION OF CATARACT

ALAN C. WOODS, M.D., AND E. L. BURKY, M.D.
BALTIMORE, MARYLAND

Lens protein consists of three distinctive and different proteins—alpha, beta, and gamma crystallins. Alpha is the strongest in its organ-specific reactions and when separated from the two others may behave as an antigen in the homologous animal. Experimental production of cataract has occurred only in the young of treated mothers. The two groups of theories with regard to the application of knowledge concerning lens protein are discussed. From the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital. Read before the Association for Research in Ophthalmology, in Milwaukee, May 10, 1933.

The various theories which seek to explain senile cataract as a result of immunological processes are all based on the physio-chemical and antigenic properties of lens protein. Properly to understand the theoretical basis of an assumed relationship between these properties of lens protein and cataract, we must first understand certain of these physio-chemical properties of lens protein and its immunologic and antigenic peculiarities.

Physio-chemical properties of lens protein: As early as 1894 Mörner[1] showed that lens protein was a complex substance. When macerated whole lens substance is emulsified, either with water or with a weak solution of ammonium hydroxide, there results an insoluble residue, while the remainder goes into solution. The insoluble portion was termed "albuminoid*." The soluble portion contained in the supernatant fluid may be further divided by the addition of one percent acetic acid, which causes a precipitate. This precipitate was termed "Alpha Crystallin" by Mörner. It may be redissolved by adding tenth-normal ammonium hydroxide and reprecipitated by the addition of acetic acid. The supernatant fluid after the first acetic-acid precipitation contains a second crystallin termed "Beta Crystallin" by Mörner. This may be purified by dialyzing in a collodion sac in tap water until the excess of acid is eliminated, and again adding further acetic acid to remove any remaining traces of the alpha crystallin. An albumin was also isolated by Mörner. His early studies were done without careful control of the *p*H of the solutions, and the alpha and beta crystallins thus isolated each contained traces of the other. These fractions, however, were distinct in their chemical composition, even in their impure state. This chemical individuality of the alpha and beta crystallins was later confirmed by Jess[2]. Jess further studied the quanitative amounts of alpha and beta crystallin in normal and cataractous lenses, and their variation at different ages. He found that in old age, and in cataractous lenses, the amount of the alpha fraction was decreased. Also in cataracts, the absolute amounts of both are reduced.

Woods and Burky[3] further studied the various fractions of lens protein, seeking to prepare pure alpha and beta crystallins, and to determine whether they were immunologically distinct. To determine the purity of their preparations they injected the various fractions into rabbits and tested the resulting antiserums with the various antigens. They found that alpha and beta crystallins, when prepared by the old method, each contained traces of the other and were immunologically impure. However, by the precipitation of the alpha and beta crystallins at their iso-electric points (the point of minimum solubility where a protein is neither acid nor

* By definition "albuminoid" is a protein insoluble in water or in weakly alkaline or acid-extracting fluids. This insolubility may be due to the inherent nature of the protein, or may be due to the chemical manipulation to which the original substance has been subjected. In previous publications by Woods and Burky the term "albuminoid" has been misused in several instances. It has been implied that "albuminoid" was a form of albumin. This error has been accepted by various writers and there is a constantly increasing volume of literature that also misuses the term.

alkaline) and repeated reprecipitation, they succeeded finally in preparing serologically pure antigens. The iso-electric point of alpha crystallin was from *p*H 5.0 to *p*H 4.8, and of beta crystallin from *p*H 7.4 to *p*H 6.0. These investigations further showed that the albuminoid of Mörner was probably either an insoluble form of alpha, or contained alpha crystallin, for antiserums prepared by the injection of the albuminoid in animals precipitated with alpha antigens but not with beta antigens. The beta fraction was later shown to contain a separate albumin fraction which was termed the "gamma" crystallin[4]. This fraction is probably the albumin fraction described by Mörner.

Later chemical investigations by Krause[5] showed that the chemical composition of the albuminoid and alpha fractions were somewhat similar. The albuminoid fraction contained slightly more sulphur and a higher ash percent than did the alpha crystallin, and certain further differences were shown in the distribution of the nitrogen content. In a second paper Krause[6] reported the chemical composition of the beta crystallin, the gamma crystallin, and the capsule. These chemical studies have shown that the three proteins of the lens, the alpha, the beta, the gamma, and the capsule are all definite chemical entities, each distinct from the other. The alpha and beta crystallins appear to be pseudoglobulins, although Krause classes beta crystallin as a euglobulin on its chemical characteristcs. Gamma crystallin is the albumin of the lens, while the capsule appears to be an unusual protein, its reaction being suggestive of an amino-carbohydrate. In addition to these fractions, Krause found a carbohydrate in the lens, but in minute quantities. He was unable to state whether the carbohydrate of the various portions was different or the same.

Antigenic properties of lens protein. In 1903 Uhlenhuth[7], in a series of experiments on cattle, showed by percipitin tests on the serums of animals immunized to lens and other proteins from different species of animals that the lens protein could be differentiated from the vitreous and other body proteins. The lens protein was organ-specific and not species-specific. The serums of cattle immunized to a foreign lens protein reacted in the precipitin test with any antigens of lens protein, regardless of the species from which derived. Likewise such serums did not react with the blood serum or usual body protein of the species from which the immunizing lens protein had been derived. In other words, lens protein was immunologically the same in all animals, and differed sharply from the general body protein. In the crystallin lens of the eye the animals harbor a protein which immunologically is foreign.

The immunological finding was studied at length by other investigators. It was confirmed by Kraus, Doerr, and Sohma[8], by Andrejew and Uhlenhuth[9], by Kunifusa[10], by Hektoen and Schulhof[11], by Woods and Burky[3], and others. On the other hand, Makino[12] could not demonstrate that such organ-specificity was a settled fact, and Braun[13], in a recent series of experiments, not only could not demonstrate organ-specificity for lens protein, but was unable to produce precipitins in a rabbit by the injection of foreign lens protein. Braun's results are so directly in opposition to the well-established results of other investigators that one is forced to conclude that technical errors in immunization must be responsible for his results.

A natural corollary to such peculiar immunological properties for lens protein would be the ability of an animal's own lens, an immunologically foreign protein, to produce a hypersensitivity or immune reaction in the host. Here the results of the various investigators are highly conflicting. Uhlenhuth and Handel[14] did discissions of the lens of one eye of guinea pigs and later extracted the lens of the second eye, prepared an emulsion, and injected this material intracardially into the same guinea pig. Death resulted which they believed was anaphylactic in nature, the animal having been sensitized by the discission and intoxicated by the intracardial injection. Mita[15] and Krusius[16] confirmed this observation, and von Szily and Arisawa[17] extended it and produced evidence that indicated a

guinea pig would be sensitized by discission of the lens of one eye and later intoxicated by discission of the lens of the second eye. Later investigations by other observers gave exactly contrary results. Römer and Gebb[18], and later Rötth[19], repeated these experiments and failed to find any evidence of hypersensitivity to lens protein after discission of the lens, or the intracardial injection of homologous lens protein. Riehm[20] likewise obtained similar negative results.

The question of autosensitization and autoimmunization was further investigated by Hektoen and Schulhof[11], by Hektoen[21], and by Woods and Burky[3]. Hektoen and Schulhof showed that the alpha and beta crystallins were precipitinogenically distinct from each other. The serums of rabbits immunized to the alpha fraction did not react with antigens of the beta fraction and vice versa. Hektoen was unable to produce precipitins in the rabbit by the injection of homologous (rabbit's) whole-lens protein. He found, however, that if a rabbit had been immunized to foreign-lens protein, and the precipitin titre allowed to fall to zero, the later injection of homologous lens protein caused the production of fresh specific antilens precipitins. This reaction, however, is not necessarily the specific production of auto-iso-antibodies by a homologous protein. It falls under the general class of anamnestic reactions which in their essence are the blood-stream mobilization by a nonspecific stimulus of the remaining antibodies still attached to the fixed cells.

As already noted, Woods and Burky[3] reworked this subject of the fractional division of lens protein. They found the fractional antigens, alpha and beta, prepared by their methods were immunologically pure and distinct. The serums of rabbits immunized to alpha crystallin reacted in the precipitin reaction only with alpha antigen, and the serums of rabbits immunized with pure beta crystallin reacted only with beta antigens. They further found that both these fractions were organ-specific in their reactions and were not species-specific. The gamma crystallin, the albumin of the lens, was inert as an antigen when injected into rabbits, but acted as a fair antigen *in vitro*, following the usual role of albumins. It precipitated with serums immune to whole lens. In this it acts as a hapten, although it is protein in nature. Hoffman[22] repeated these immunological studies of Woods and Burky, and confirmed the fractional specificity of alpha crystallin, but could not show such specificity for beta crystallin. A study of Hoffman's technic shows that the difference is probably due to the method of preparation of the beta crystallin. Burky, Woods, and Woodhall[23] next studied the question of the production of auto-iso-antibodies by whole lens protein and the separate crystallins, or the ability of these substances to act as a foreign protein when injected into the species of animal from which they were derived. They found the whole-lens protein, the beta, and the gamma crystallins were inert when injected into the homologous animal. Numerous discissions in the same animal did not cause the development of precipitins or an anaphylactic state. The purified alpha crystallin, however, produced definite, specific precipitins for alpha crystallin when injected into the homologous animal, rabbits, swine, and calves being used to substantiate this finding. Thus rabbit alpha crystallin produced alpha precipitins when injected into rabbits, swine alpha crystallin produced alpha precipitins when injected into swine, and bovine alpha crystallin produced alpha precipitins in calves. These alpha precipitins were likewise organ-specific and not species-specific. This suggests that the immunologically active portion in the homologous animal must be the alpha crystallin.

Summing up the work on the physiochemical and immunological properties of lens protein, it is seen that lens protein is complex, consisting of three different proteins, a pseudoglobulin (alpha), a second pseudoglobulin (beta) or possibly a euglobulin, and an albumin (gamma). Each of these proteins is distinct and different in its chemical composition, its iso-electric point, and its immunological reaction and speci-

ficity. The capsule represents a fourth protein in the chemical composition, but its immunological reactions have not been studied.

The basic fact of the organ-specificity and lack of species-specificity for whole-lens protein is well established. Alpha crystallin is truly organ-specific, while beta and gamma are only in some measure organ-specific. The gamma crystallin is inert immunologically in animals, unless combined with one or both of the other fractions. Lens protein may be considered as different from the general-body protein of the animal. It is by no means clear, as might be supposed, that lens protein can act as an antigen in the homologous animal. As will be pointed out later, positive skin reactions to lens protein occur in the human only in a limited percentage of individuals exposed to its absorption. Experimentally, the work on this point is conflicting. The later work of Burky, Woods, and Woodhall[23] indicates that such a property is limited solely to the alpha crystallin and is not enjoyed by whole-lens protein. It appears that association with the beta and gamma fractions inhibits this action of alpha crystallin, since it can produce iso-precipitins only when separated in pure form. In whole-lens protein, associated with the beta and gamma fractions, alpha is inert in the experimental homologous animal.

The experimental production of cataracts by immunological procedures. If the antigenic properties of lens protein are related to the phenomenon of cataract in the human, one would suppose that by some immunological procedure with antigens of lens protein, or its fractions, one might produce cataracts in experimental animals. However, all the experiments aimed at the production of cataracts in experimental animals, by direct sensitization, intoxication, or immunization with whole-lens protein, have been without results. In the offspring of pregnant mothers so treated, certain ocular defects, centered chiefly about the lens, have been found. It has not been demonstrated, however, that such lenticular defects are specifically related to the immunological procedures to which the mothers were subjected.

In 1918, 1920, and 1922 Guyer and Smith[24] reported their experiments on the prenatal effect of lens antibodies. An antilens serum was prepared in fowls by the injection of rabbit-lens protein, and precipitins to lens protein were demonstrated in this serum. This antilens serum was injected into pregnant rabbits, six such injections being given at three-day intervals. A number of the young of the mothers thus treated showed opaque, or entirely liquid lenses. Similar defects in the young were produced by the direct injection of lens substance in the pregnant rabbits. Control experiments, in which the pregnant mother was injected with normal fowl serum or the serum of fowls immunized to rabbits' testes, were negative, the young of such animals having normal eyes. These lens defects in the young they believed were due to a direct attack of the lens antibodies on the lens of young rabbits *in utero*. They regarded the liquefaction of the lens as a true cytolytic effect, the lens cytolysins acting directly on the lenses of the embryonic rabbits. They believed that the reason the eyes of the young were attacked, and not the eyes of the mother was that the embryonic eye is surrounded by a tunica vasculosa and not by a capsule impermeable to cytolysins. Incidentally, they further showed that these induced eye defects could be transmitted to descendants for at least six generations without further treatment with lens or sensitized serum, a point not germane to this discussion. In further support of the belief that the lens changes were due to action of the lens antibodies in the embryonic lens, Guyer[25] showed in 1922 that male rabbits may develop spermatotoxins against their own spermatozoa. In 1924 Guyer and Smith[26] showed that the placenta of rabbits is permeable to precipitins and agglutinins, and in 1925 Guyer[27] reported that needling the lenses of rabbits resulted in the occurrence of precipitins in the blood serum in 50 percent of the animals treated.

These conclusions of Guyer and Smith were sharply challenged by von Szily[28], who believed that the lesions reported by Guyer and Smith were quite typical of hereditary eye defects,

and it was well known that such defects occurred with fair regularity in certain strains of defective rabbits. Koyanagi[29] conducted breeding experiments and showed by inbreeding defective strains of rabbits that such defects occurred in 24.8 percent of the stock. Davis[30] studied the stock of Guyer and Smith and believed that the ocular lesions were caused by the failure to close, or improper closure, of the fetal ocular cleft. Poynter and Allen[31], Ibsen and Bushnell[32], Huxley and Carr-Saunders[33], and Davis and Smith[34] conducted breeding experiments similar to those of Guyer and Smith, and were unable to produce eye defects in the young of pregnant rabbits, either by the active or passive immunization of the mothers with lens protein or antilens serum.

A heretofore unreported experiment by Burky and Woods, however, supports the original experiment and conclusions of Guyer and Smith[24]. This experiment was as follows: In the breeding pens of the Wilmer Institute was a group of guinea pigs, one buck and four does. These pigs were most prolific, producing litters of young repeatedly over several years. The offspring of these pigs were used for various experimental purposes, and the eyes of all were regularly examined with negative results. It was therefore known that these pigs produced young for several years without ocular defects, and in several instances the descendants had been followed for three or four generations and ocular defects were never found. From this stock a group of pigs was selected. They were injected intraperitoneally with alpha crystallin, beta crystallin, or whole-lens extract. Four weeks later a few of this group were injected intravenously with shocking doses of the antigen used to sensitize. All of the injected animals died with a typical anaphylactic picture. The remainder of the animals were needled. The resulting intraocular reactions were hard to estimate but they seemed greater in the sensitized animals than in the normal needled controls. Three days after the needling, the guinea pigs were bred. Of the young born two months later, 18, or about one-half, had definite and typical congenital cataracts. These cataracts were observed on the day of birth and daily thereafter. By the tenth day the cataracts had entirely disappeared. Similar results were obtained in a second lot of animals. About one month after the last pigs were born an epidemic of pneumonia destroyed the entire stock of guinea pigs. The experiment has not been repeated because our breeding attempts have failed.

A similar and more extensive experiment has been undertaken in rabbits. In this we have planned to repeat the work of Guyer and Smith[24], but before undertaking any experimental procedures we have bred the animals for at least three generations. Thus far in a closely inbred, normal stock we have found only one rabbit with a defective eye—in this case a conical lens. This animal, a male, has not reproduced his defect in the F1 generation. The number of normal animals thus far observed has been about five hundred. Among the F2 generation of one treated rabbit we have found one positive posterior polar cataract. This animal was one of a litter of six. Because of the necessity of establishing a strain of pedigreed rabbits, the number of animals thus far treated has been small and no prediction can be made concerning the eventual outcome of this experiment.

Hyde, McKee, and Chapman are at present further investigating this question in the School of Hygiene of the Johns Hopkins University. With the permission of these investigators we are allowed to quote some unpublished observations of theirs on the production of cataract. From a stock of about five hundred animals with normal eyes* they selected females for injection with normal serums, serums immune to lens, and lens emulsion. During the course of the injections the animals were mated. Eight mothers injected with normal serum produced eight litters of normal-eyed young. Twenty-six mothers were injected with lens-immune serum and produced 26 litters containing 99 individuals. Two defective eyes in two specimens were found. Both had lens

* One of us has examined the eyes of this stock.

opacities with coloboma. Twenty-six females were injected with lens emulsion. Twenty-six litters contained 64 individuals, of which 16, or 25 percent, had defective lenses. The majority of these were not complicated by colobomas.

The question of the production of cataracts in the young by immunological procedures with lens protein in the mothers must therefore be regarded as unsettled. The experiments of Guyer and Smith[24,25] command respect and attention, although they have been seriously questioned and have not been confirmed. They receive definite support in the above-reported, but inconclusive, experiments of the present authors, and in the recent experiments of Hyde, McKee, and Chapman.

Immunologic reactions to lens protein in normal and cataractous humans. Patients with various forms of cataract have been studied extensively in the effort to find some immunologic reaction to lens protein. The blood serums of such patients have been investigated in the Abderhalden test, the precipitin test, the complement-fixation reaction, and the refractive index. Römer[35] reported one instance in which he found precipitins to lens protein in the blood serum of a young diabetic with cataract, and Gourfein-Welt[36] reported a slight change in the refractive index of cataractous serums investigated under rather peculiar conditions. Aside from these two investigators, the various reports on this subject give entirely negative results, as far as can be found.

The following unpublished experiments by Burky may be mentioned here. At various times when patients with positive lens-skin reactions were available, the following studies were done with the idea of showing a serological reaction in the hypersensitive individual: Serum was obtained from human beings hypersensitive to lens protein. To 0.5 c.c. amounts of such a supposedly hypersensitive serum were added 0.5 c.c. amounts of lens extract diluted 1:100, 1:1000, 1:10,000, 1:100,000 and 1:1,000,000. As might be expected no visible precipitation occurred. These lens-serum mixtures after incubation were mixed with a whole-lens-immune rabbit serum. This was done with the idea that the antigenic action of lens protein responsible for a reaction in the skin might be destroyed or altered if the lens protein were mixed with a hypersensitive serum. This destruction or alteration of the antigenic activity of the lens protein could then be detected in a precipitation test with the lens-immune serum. In certain instances such an expected result was obtained, but in others the precipitate was increased rather than decreased. At present we can only say that some change in the precipitin reaction can be effected by adding hypersensitive serum to the lens antigen. To our knowledge, similar serological studies have never been reported with lens or other antigens, so that until a larger body of knowledge has been accumulated no conclusions can be drawn.

Cutaneous and intracutaneous tests with lens protein, seeking to determine a hypersensitivity, have given conflicting results. Verhoeff and Lemoine[37] found such a hypersensitivity to lens protein in certain patients who showed sterile ocular inflammation after the second discission, and in patients where lens material was left in the eye after cataract extraction. This was the basis for their theory of endophthalmitis phaco-anaphylactica, a subject not germane to this discussion. This conception of disease entity was challenged by certain German investigators, notably Rötth[19], Riehm[20], and Braun[18], whose work has already been mentioned. Lemoine and MacDonald[38] found that 14 of 168 cataractous patients gave a positive intracutaneous test to lens protein, and Courtney[39] found that 5 of 26 cataractous patients developed a hypersensitivity to lens protein after cataract extraction. Gifford[40] found that 12.6 percent of cataractous patients gave positive cutaneous tests to lens protein, but as a result of clinical and experimental studies he concluded that the positive reactions were due to an inherent toxicity of the lens material. A somewhat similar opinion was later reached by Braun[41], who studied the action of lens protein in the Dale technic on the uteri of normal and sensitized guinea pigs. Burky and Woods[42] further investigated this point. They found that if bacterial

growth were inhibited during the preparation of the lens protein, the resulting preparation was nontoxic, nonirritating, and entirely inert in normal individuals. Seventy-five normal individuals were tested intracutaneously with such a preparation of lens protein and in no instance was a positive reaction found. Sixty-four cataractous individuals were similarly tested, some before and some after operation, and 11, or 17 percent, of these patients showed positive reactions. Rabinovitch[43] used a lens extract prepared after the manner advocated by Verhoeff and Lemoine[37], and likewise obtained a certain number of positive reactions in cataractous patients.

The weight of evidence, therefore, clearly shows that a certain percentage of cataractous patients may have a definite hypersensitivity to lens protein, and certain others, negative to lens protein before operation, may develop such a hypersensitivity to lens protein when exposed to its absorption by cataract operation.

Theories on the possible relationship of lens protein to cataract. Thus far we have considered only scientific investigations. The results of these investigations have in many instances been conflicting. Yet, in every instance they have been carefully controlled, and in the main have yielded much valuable information on the physio-chemical and immunologic properties of lens protein and its reactions in animals and man. We now pass from the field of scientific investigation into the field of theory. And what do we find? The theories on this subject may be divided into two general groups. The first group consists merely of interesting suggestions advanced by various investigators on the properties of lens protein. These observers, of whom the present authors are among the chief offenders, have pointed out that certain observed phenomena may possibly be related to cataract. The second group consists of definite theories which seek to explain senile cataract as an immunologic phenomenon. On these theories have been based certain therapeutic procedures.

The first group of theories is centered chiefly around certain observations made on the precipitation of lens protein by electrolytes, and the spontaneous precipitation of the beta fraction. Burge[44] found that cataractous lenses contain a higher percentage of calcium than do normal lenses, and that fish kept in media enriched with calcium tend to develop cataracts. In our experiments on lens protein and its fractions we have observed certain interesting phenomena relative to the precipitation of whole-lens protein, and the alpha and beta crystallins, by different concentrations of calcium. The observations have never been worked out in detail sufficient to justify a separate report, nevertheless, for their bearing on the general problem under discussion, they may be mentioned here.

Previously we observed that when a beef lens, removed in capsule under sterile precautions, was suspended in aqueous humor enriched with $CaCl_2$, definite polar opacities developed in the lens. These opacities were observed when the concentration of $CaCl_2$ approached half saturation, a concentration too low to cause a salt precipitation in the aqueous. We then added $CaCl_2$ to preparations of whole-lens protein, prepared as outlined in previous papers. Again, it was found that when the concentration of $CaCl_2$ approached one-half concentration, a definite precipitate appeared in the mixture. In like manner, we determine the levls of $CaCl_2$ concentration which produced precipitation of the alpha and beta crystallins. It was found that small amounts of $CaCl_2$ caused precipitation of the alpha crystallin. When the calcium concentration approached the physiological level of approximately 9 mgm. percent, a precipitate occurred in the preparation of alpha crystallin. The situation with beta crystallin was quite different. In order to produce precipitation of the beta crystallin it was necessary that the concentration of calcium be high—over one-half saturation. When alpha and beta crystallins were mixed, it immediately required high concentrations of calcium to produce precipitation. Apparently the beta crystallin exerts a protective action on alpha as far as precipitation by calcium salts is concerned. The observations suggests at once that

any alteration in the alpha-beta ratio, especially a decrease in the beta content, might well make lens protein susceptible to precipitation in the presence of calcium salts.

Does any alteration in the alpha-beta ratio exist in cataracts, or in old age? We have no positive knowledge. Jess, working with older methods, reported that the beta crystallin increased in cataractous lenses. If true, this would invalidate the suggestion just advanced. But Jess's observations have never been confirmed, and we have at least the hypothetical possibility that should the beta crystallin decrease with age and in cataractous lenses, calcium in the normal physiological or slightly elevated, concentration might well act as a precipitating agent.

If we accept Jess's[2] report as accurate, certain other observed phenomena at once become most interesting. In our first report we pointed out that beta crystallin, when separated from whole-lens protein, has a definite tendency to spontaneous precipitation within the normal *p*H limits of body fluids, about 7.2. Alpha crystallin, however, only precipitates in acid solutions, where the *p*H is 5 or lower. When alpha and beta crystallins are mixed in whole lens protein, there is no tendency to spontaneous precipitation within the normal physiological *p*H limits, alpha apparently having a protective effect on the beta crystallin and preventing its precipitation. Theoretically, we might assume that a decrease in the alpha fraction with age removes this protective reaction, and allows the spontaneous precipitation of the beta crystallin. Thus, on this basis, cataract might be considered a normal physiological reaction in the aged, due to the increase in the beta fraction and decrease in the alpha fraction, which occurs in the steadily growing and changing crystallin lens.

Should one care to speculate further in this vein, it may be pointed out that alpha crystallin is by far the most immunologically active constituent of lens protein. If it exerts any antigenic action on the homologous individual, it would theoretically cause the production of cytolysins and precipitins. True, we cannot demonstrate such antibodies, but still the possibility of cytolysins is hard to exclude. Such antibodies, reacting with alpha crystallin would precipitate it or render it inert, in the latter case accelerating the spontaneous precipitation of the beta crystallin.

In short, the possibilities for speculation are boundless. Starting with a few interesting and not clearly understood observations, we may build beautiful theories which explain the etiology of cataract. The only difficulty is that we cannot prove these theories, nor can they be subjected to too close scrutiny. They are beautiful but terrible fragile. They have, however, the asset of extreme elasticity, and one can take refuge in a side road and immediately the whole problem of cataract again becomes clear.

The second group of theories concerns cataracts as an immunological procedure, and is the basis for certain therapeutic procedures. These theories pivot about the assumption that the peculiar antigenic properties of lens protein are exerted in the homologous individual, and some further development of such an immunologic reaction results in cataracts.

Shortly after Uhlenhuth's[7] discovery of the antigenic properties of lens protein, Römer[35] attempted to explain cataracts on such a basis. He believed that lens protein might act as an antigen in the homologous individual and produce specific antibodies, cytolysins for lens tissue. In one instance he reported finding such antibodies in the blood serum of a young diabetic with cataract. In Römer's theory, such lens cytolysins might diffuse through the capsule of the lens, attack the clear lens protein, and so produce cataracts. He believed these lens cytolysins to be more abundant in cataractous than in normal individuals. He studied the question of the permeability of the lens capsule to cytotoxins and reached the conclusion that cytotoxins might diffuse through the capsule of the lens and produce organic changes in the lens. It may be immediately pointed out here that it has long been known that all antibodies are either contained in the globulin portions

of the serum, the pseudo- or euglobulins, or are intimately associated with these portions, and Hess[45] in 1911, and Friedenwald[46] in 1930, both showed the lens capsule to be impermeable to such globulins. However, Römer[47] proceeded with therapy based on this assumption. Tablets called "Lentocalin" were prepared from beef lenses and were administered by mouth to 165 cataractous individuals. Just how they were supposed to act is a little difficult to understand, and this method of treatment failed to enjoy further popularity, although Römer believed that these patients showed some improvement.

Specific therapy for cataracts was again brought up by A. E. Davis[48] in 1923, who offered a more easily followed theory for such treatment. Primarily, Davis believed that the injection of lens protein into the body caused the production of specific lens antibodies, as it should and quite probably does, although the one patient we have studied, who had received the full course of lens injections, failed to show any precipitins against lens protein in the blood stream. Secondly, Davis believed that such antibodies acted selectively on the decomposed and opaque lens fibers, caused their liquefaction and so brought about the cure of cataract. Here, however, he runs into the same stumbling block as did Römer[47]. All the weight of evidence is against the lens capsule's being permeable to cytotoxins or other antibodies. In line with this theory, Davis treated cataractous individuals with lens antiserum prepared in animals. On account of the unpleasant serum reactions accompanying this treatment it was abandoned, and the direct immunization of the patient with lens antigen substituted. Davis reports that of 131 patients thus treated, 86, or about 66 percent, showed total arrest or improvement in the cataracts. In a later paper[49] he reported that 80 to 85 percent of subcapsular senile cataracts, and 75 percent of cortical cataracts, are arrested or improved by such treatment, while nuclear and capsular cataracts are not affected. These clinical results, however, have not been confirmed by other investigators. Ellis[50] treated 27 cataractous patients with this method, and while in 13 the condition remained stationary, in the remaining 14 the cataracts progressed. In no case did he observe any absorption of the cataract or improvement in vision. Berens[51] treated nine patients with this method. One patient showed a decrease in the peripheral opacities, but an increase in the central opacity. In one patient the cataract remained stationary, but in the remaining seven they rapidly progressed.

Several South American ophthalmologists are somewhat in accord with Davis. Marquez[52] and Allende[53] believes that the absorption of lens remnants left at operation, and of secondary cataracts occurring after discission or trauma, is hastened by the subcutaneous injection of lens protein. They believe that the lens antigen produces cytolysins which act directly on the unabsorbed lens, and thus control the inflammatory symptoms that may occur after cataract.

Comment and Summary

The subject of the possible immunologic relationship of lens protein to cataract may be quickly summarized. Lens protein is complex, and consists of at least three different proteins, excluding the capsule. These proteins are chemically and immunologically distinct. Whole lens protein is organ-specific, and largely, if not totally, devoid of species-specificity. The alpha fraction is the strongest in its organ-specific reactions. There is definite evidence that the alpha fraction, isolated from its companion proteins, may act as an antigen in the homologous animal; but when it is combined with its companion proteins, this iso-activity is inhibited. The experimental production of cataracts by immunological procedures is a controversial subject, and at best has only been observed in the young of treated mothers. The weight of evidence indicates the fully developed lens capsule is impermeable to antibodies, but we have no information on the permeability of the embryonic capsule, and it is quite logical to suppose the partially developed lens capsule may differ radically in its permeability. While there is much excellent evidence that argues against

such congenital lens defects being due to an immunologic process, nevertheless recent experiments have again opened up the question. There is little convincing evidence that the lens protein from the unruptured capsule may exert any antigenic activity in man, certainly not to the point of producing cytolysins or precipitins. A certain small percentage of cataractous individuals may have a definite hypersensitivity to lens protein, but it is not clear whether this is acquired or congenital. It is apparently well demonstrated that after rupture of the lens capsule a certain percentage of individuals may develop a cutaneous hypersensitivity to lens protein, the only apparent source of which is their own lens which presumably acts as the sensitizing antigen.

Suggestions and theories on the causation of senile cataract through the physio-chemical and immunologic properties of lens protein belong more to the realm of poetry than to the domain of science. From the first investigations of Uhlenhuth thirty years ago up to the present time, the different investigators of the physio-chemical and immunologic properties of lens protein have gradually unearthed one interesting observation after another. These observations are stimulating, and quite naturally lead to speculation as to their possible importance in the problem of cataract. It is quite possible to offer suggestions and build up theories on these observations. Some collapse immediately of their own weight, while others command thought and attention. What time and further investigation may reveal is impossible to say. Yet, at the present time it is impossible to regard these suggestions and theories as more than fantasies. The gaps between the few known facts and the final conclusions are too great and strewn with too many obstacles to be hurdled by even an immunologic gymnast. All we can do now is to bring in the Scotch verdict—"Not proven."

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Discussion. DR. E. L. BURKY: I should like to mention that the stereo view of the rabbit's eye is one of a cataract produced by the injection of whole lens into a mother during the course of her pregnancy and that the rabbit has no defects that we can find other than a cataract which extends through the posterior half of the lens.

DR. WILLIAM L. BENEDICT: I should like to ask Dr. Burky if in the guinea-pig experiments you found there was a family of guinea pigs that developed opacities in the lenses and cataracts which later disappeared. Where were those opacities and by what means do you think they were cleared up?

DR. BURKY: The best description I can give you of those cataracts is that they were diagnosed by Dr. Wilmer as typical congenital cataracts. He made the diagnosis on all of them. We followed the guinea pigs from day to day and Mrs. Burgess, the artist in the Institute, started to draw pictures of them. They changed so rapidly we never did get a completely finished picture. Why they cleared up, I haven't any explanation. We thought at first they might have been cataracts of the "cold" type.

DR. GEORGE N. HOSFORD: Did Dr. Davis use human or animal lens antigens?

DR. BURKY: His lens antigens were made by Mulford and as far as I know, were beef lenses.

AN EXPERIMENTAL STUDY OF CORNEAL VASCULARIZATION*

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Experimental trachoma in animals has never developed pannus. A study was instituted to ascertain the capacity of the animal (rabbit, M. rhesus) cornea to produce this formation as a response to bacterial and protein hypersensitiveness. Conditions resembling both the early form of trachomatous pannus and pannus crassus were induced by the inoculation of bacterial and protein antigens, and continued so long as the inoculations were repeated, receding with their cessation, but never entirely disappearing. This corneal response was unassociated with skin reaction to the same antigen or with circulating antibodies. From the Oscar Johnson Institute, Washington University School of Medicine. Conducted under a grant from the Commonwealth Fund of New York.

While transfer of the follicular condition of trachoma to apes and monkeys is accomplished with relative facility, the reproduction of the corneal reaction of cloudiness and pannus has never been attained. Whether this lack of reactivity is due to an inherent inability of the infectious process of trachoma to initiate the corneal reaction or whether the cornea of these animals is peculiarly resistant to pannus formation still remains to be determined. Because of the importance of the corneal involvement in trachoma the necessity is obvious for studying the conditions under which vascularization of the cornea is stimulated.

The experiments of Derick and Swift[1] as well as those of one of the present authors[2] demonstrated that bacterial hypersensitiveness may manifest itself by a corneal reaction which consists chiefly of cloudiness and pannus. Therefore it was decided to study vascularization of the cornea as a hypersensitive response to bacteria and proteins.

Experimental

The corneal reaction was studied in both rabbits and monkeys. Animals were first made hypersensitive[3] by repeated, periodic injections of the specific antigen either intracutaneously or subconjunctivally or by direct inoculation of the cornea. In the latter instance bacteria were inoculated by scarification of the cornea (a single, light scratch with cataract knife extending from beneath the superior sclerocorneal margin to the pupil) and by instillation of 2 drops of the young culture into the conjunctival sac. With protein antigens, this method was used also, but preference was given to direct intracorneal injection*. The antigens studied included Staph. aureus, Pneumococcus, B. granulosis, crystalline egg albumin, and nucleoprotein solutions of Staph. aureus and B. granulosis. Since no distinction in corneal reactivity referable to a respective antigen was observable, the reaction will be described as a general response of the cornea to hypersensitiveness rather than as a reaction to a particular antigen.

Sensitization of the cornea of rabbits to bacteria. The vascularization of the cornea observed in response to bacterial hypersensitiveness occurred with greatest frequency and regularity in rabbits inoculated repeatedly with Staph. aureus. The most effective method of sensitization was by scarification of the cornea of one eye with subsequent instillation of culture in the conjunctival sac. For the sake of brevity and clarity, the experiments conducted with Staphylococcus by corneal inoculation will be described as typical of the corneal reaction in bacterial hypersensitiveness.

The results of these experiments indicate that following the first 3 to 5 inoculations, no visible reaction occurs in the eye, as determined by careful examination with a hand slitlamp. From the fourth to sixth inoculation, usually the cornea and conjunctiva undergo a

* All corneal inoculations were made under anesthesia—in rabbits with novocaine, locally, and in monkeys with complete ether anesthesia.

very definite reaction. On the day following the particular inoculation, there is a distinct injection of the vessels of the scleral conjunctiva above the scarified area of the cornea. The palpebral conjunctiva of the upper lid becomes congested and hyperemic, and after later injections that of the lower lid as well. In the more severe reactions the lids exhibit varying degrees of swelling and edema and frequently an inflammatory exudate. Simultaneously, the cornea is distinctly clouded over a quadrant or more in the vicinity of the scarification. The cloudiness appears to be an index of severity because of the variation in extent of area involved and the intensity of the cloudiness, which occasionally is almost a blue. On the second to the fifth day following the inoculation, there is a definite encroachment of the conjunctival vessels on the cornea. This vascularity appears at first in the form of delicate twiglike vessels just over the limbus. The vessels then form fine capillary loops which show anastomoses, and at this stage resemble very closely the descriptions and illustrations of early pannus in trachoma as recently described by Wilson[4]. About the time that the next inoculation is made, the vessels begin to descend over the cornea, not as loops but as a curtain of single vessels and with repeated inoculations terminate in crow's-foot or brushlike processes. With further inoculations, the vessels eventually appear from all directions reaching centripetally from the entire circumference of the cornea. At this stage, the vascularization is suggestive of the pannus crassus observed in trachoma. Clouding always precedes the vascularization, so that eventually the whole cornea is clouded, sufficiently in some instances, to obscure completely the pupil. When the inoculations are discontinued, the corneal reaction begins to recede. The cloudiness disappears within 1 to 3 weeks depending upon the intensity, and the blood vessels remain grossly visible for weeks or months, after which examination with the hand slitlamp fails to reveal their presence. As long as the inoculations are repeated, however, both the cloudiness and pannus may be maintained, so that in the rabbits which received 22 inoculations, this condition of the cornea remained present for several months. Moreover, it was later discovered that the vessels actually never disappear and that micropathological examination discloses their presence when they are no longer visible to the unaided eye.

The beginning and maximum corneal reactions of hypersensitiveness are illustrated in Plate IV.

Sensitization of the cornea of rabbits to proteins. While the indications are that the corneal reaction described above is indeed a manifestation of hypersensitiveness, it is nevertheless impossible to define exactly the part played by the infection as such from the existing hypersensitiveness. That there is a similar condition of the human eye designated as interstitial or parenchymatous keratitis, in which vascularization may occur, made it appear possible that the reaction might be essentially one of infection. In order to determine whether the vascularity of the cornea under the experimental conditions described was due entirely or in part to repeated infection, hypersensitiveness, or some other factor, further experiments were undertaken on pannus formation in the cornea of rabbits as stimulated by direct sensitization to filtered, sterile, protein solutions.

Rabbits were sensitized to the proteins either by weekly intracutaneous injections, by intracorneal injections, or by corneal scarification and instillation. The amount of material injected was 0.1 or 0.2 c.c. which contained up to 4 mgm. of protein in the case of albumin, and about .005 mgm. of bacterial protein. The small dosage in the case of the bacterial protein was necessary because of the toxicity in large quantities of the bacterial protein when injected intracorneally. Since the reactivity of the cornea was essentially similar, irrespective of the protein used or the route of sensitization employed, a description will be given of the corneal response to repeated injections of egg albumin, as typical.

Each injection was followed immediately by a circular, white to grey reac-

tion at the point of inoculation. This disappeared within several hours after which the cornea recovered its normal appearance. For purposes of control and orientation, rabbits were given similar injections of 0.2 c.c. salt solution. It may be said here that the successive weekly injections of salt solution caused no reactions so that the possibility of trauma, extracellular pressure in the cornea, or even denaturization of the corneal protein, which might have yielded thereby an antigenic foreign protein, was eliminated as a potential factor in the observations made following injections of proteins. With repeated injections, the vascularity and clouding became more pronounced until the whole cornea was involved. There was always a great deal of sterile inflammatory exudate, frequently with edema of the lids, both of which persisted for only 24 to 48 hours. Occasionally a hemorrhagic area seemed to surround the new blood vessels and there was pitting of the cornea. More rarely a phlyctenulelike reaction of the conjunctiva was observed adjacent to the superior limbus. The later injections were followed by severe reactions and in this stage were not particularly reminiscent of the vascularization encountered during the course of trachoma. After the injections of egg albumin were discontinued, the reactions began to recede, weeks and months being required for complete resolution.

Sensitization of the cornea of monkeys. Monkeys (M. rhesus) were studied only by the corneal inoculation of both bacteria and proteins. It became obvious immediately that the corneal reaction may be induced in monkeys with as great regularity as in rabbits. The reactivity of the cornea develops in a similar way and the course of the reaction is of the same order.

The vascularization in these animals, however, was different in clinical appearance from that described under similar experimental conditions in rabbits. The vascularity in monkeys usually began either from the inferior rather than the superior limbus or more commonly in the lower lateral quadrant instead of in an upper quadrant. Vascularization from the upper limbus was always a later development. The individual vessels were never so numerous as those observed in rabbits and vascularization from the entire circumference of the cornea was never seen. The vessels were usually started as small twigs, later forming delicate long and slender loops which in turn became single vessels with little if any ramification. Occasionally brushlike or crow's-foot terminations of the corneal vessels were seen but not so frequently as in rabbits.

Stimulation of corneal vascularity by other means. Earlier in the course of this study it was observed that clouding and vascularity of the cornea might be induced by various stimuli. Thus severe trauma, such as perforation of the eye ball through the cornea, might cause clouding and vascularization of the cornea. So also direct intracorneal injections of certain concentrations of bacterial proteins (Staphylococcus, Streptococcus, diphtheroids and B. granulosis) regularly stimulate comparable corneal reactions. Definite infection of the cornea by a variety of bacteria also affects the cornea in a similar manner. In contradistinction to the vascularity of hypersensitiveness, in these instances the vascularization generally appears within a few days following the one treatment, the vessels usually springing from the conjunctival vessel nearest the area of the cornea undergoing irritations (mechanical, toxic, infective). The vessels descending into the cornea are always few, often offshoots of a single vessel and eventually the ramifications at the terminus form a delicate vascular mesh completely surrounding the area of irritation, giving to the reaction an appearance frequently designated as a "salmon patch." From the differences in genesis as well as in appearance, it seems more appropriate to consider vascularity of this variety as a pannus of irritation rather than a pannus of hypersensitiveness. The illustrations in the frontispiece bring out very clearly the differences in appearance of the two vascularizations.

Relation of corneal vascularization to

increased activity of other tissues. Experiments were undertaken to determine whether corneal reactivity was a localized phenomenon or whether it developed simultaneously with increased reactivity of other tissues. For this purpose all the animals employed in this investigation were studied for the presence of skin reactivity and corneal reactivity of the uninoculated eye to the homologous antigen. In the animals which were sensitized to bacteria, skin tests were made with the homologous nucleoprotein rather than with the organism itself.

The results of these experiments reveal that in animals receiving corneal inoculations of bacteria or proteins, the cornea, inoculated repeatedly, always acquires an exquisite reactivity to the antigen. The cornea of the uninoculated eye, on the other hand, may or may not become hypersensitive with the result that approximately half the animals remain nonreactive in the cornea of the uninoculated eye. Skin reactivity may also be absent, so that there is no parallelism between acquired corneal reactivity of the inoculated eye and acquired skin reactivity. When animals are sensitized by some other route, as intracutaneously, the skin always becomes reactive to the homologous antigen. The corneae may remain nonreactive, the frequency of corneal reactivity depending upon the nature of the antigen.

Relation of corneal vascularization to the presence of circulating antibodies. An attempt to correlate corneal vascularization with circulating antibodies indicates no constant relationship between the two reactions, measuring antibodies by the usual technic of agglutination or precipitation. That the corneal reaction partakes of the Arthus phenomenon which is considered an antigen-antibody reaction is indicated by the effectiveness of egg albumin in inducing the corneal response and the time relationship between the direct corneal injections and clinical manifestation. Experiments were therefore conducted to determine the transferability of the corneal reaction by serum from reactive to normal animals.

In attempting passive transfer three methods were employed: (a) intravenous or local injection of precipitating serum followed on the next day by intracorneal injection of antigen; (b) intracorneal injection of a combination of antiserum and antigen; and (c) by reverse passive anaphylaxis; that is injection of antigen locally or intravenously and on the next day, intracorneal injection of antibody. The data bearing on these experiments indicate that corneal reactivity is not passively transferable by serum from reactive to normal animals. Occasional reactions were obtained but they were of the "salmon patch" variety and were probably due to the toxicity of the reagents to the normal cornea.

Discussion

A report is made in this communication of a study of corneal vascularization in rabbits and monkeys. The experiments undertaken were predicated on the concept that pannus formation in trachoma may be in response to a specific bacterial hypersensitiveness. The experimental data indicate that of the bacteria utilized for this purpose, Staph. aureus possesses the most effective sensitizing antigen, and that the most consistent corneal reactivity is obtainable by direct sensitization of the scarified cornea. When sensitized, the cornea of rabbits or monkeys may develop marked clouding and vascularization. While it is not clear that the pannus of trachoma is related to the corneal vascularization observed during this study, in the beginning stage, these changes resemble so-called pannus tenuis of trachoma, and later are suggestive of pannus crassus. By repeated periodic scarification and instillation of bacteria, pannus may be maintained indefinitely. With cessation of the instillations, the corneal changes undergo absorption so that within weeks or months the vascularity is no longer visible under examination by hand slit-lamp. By employing micropathological methods, however, it is seen that the blood vessels never actually disappear.

That the clouding and vascularization are in response to hypersensitive-

ness rather than infection was demonstrated by experiments which showed that egg albumin or bacterial proteins induce a similar reactivity.

No correlation could be determined between corneal reactivity and skin reactivity of the same antigen. Similarly, no evidence was obtained to show that the corneal reaction of hypersensitiveness is dependent upon circulating antibodies.

Summary and Conclusions

1. Vascularization of the cornea has been studied in rabbits and monkeys as a response to bacterial and protein hypersensitiveness.

2. It has been possible to demonstrate that clouding and vascularization follow the introduction of the homologous antigen into the sensitized cornea of rabbits and monkeys.

3. The corneal reaction is similar in both bacterial and protein hypersensitiveness.

4. The evidence indicates that corneal reactivity is not associated with skin reactivity to the same antigen or to the presence of circulating antibodies.

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CHANGES IN ASTIGMATISM

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This study includes the changes produced by corneal incisions, and keratoconus as well as those arising from changes in the shape of the cornea and the crystalline lens. Read before the section on Ophthalmology, Fourth Pan-American Medical Congress, Mar. 22, 1933.

Astigmatism changes. It changes in the majority of eyes, in people who live to middle life. Such changes are of practical importance, but have been unknown to most of us, who measure and correct errors of refraction; and are still unknown, ignored, or underestimated by many who suffer from them. They can be recognized only by observation with perfected apparatus and methods for accurate measurement of astigmatism.

As a young graduate in medicine the writer became interested in the action of cycloplegics, and, by experiments on his own eyes, had experienced complete cycloplegia with atropin, daturin, hyoscyamin, duboisin, scopolamin and homatropin. With each drug the amount of hyperopic astigmatism was shown to be 0.50 D. in each eye. Correcting lenses were worn constantly, and gave complete relief from symptoms of nerve strain. At the age of 28 there had been a gradual return of symptoms. Headache, pain, hyperemia of the eyes, and blurring of distant vision were experienced. Remeasurement showed the correction then required was:

R. + 0.50 D. sph. ⊂ + 1.25 cyl. axis 90°
L. + 0.50 D. sph. ⊂ + 2.00 cyl. axis 88°

These were worn with complete relief that lasted for fifteen years. At 45 recession of the near-point led to retesting of the refraction which was found to require:

R. + 0.50 D. sph. ⊂ + 1.75 cyl. axis 97°
L. + 0.62 D. sph. ⊂ + 1.75 cyl. axis 90°

At 55 the correction was:

R. + 0.75 D. sph. ⊂ + 1.75 cyl. axis 90°
L. + 0.87 D. sph. ⊂ + 1.75 cyl. axis 85°

At 75 the correction became:

R. + 0.62 D. sph. ⊂ + 1.75 cyl. axis 88°
L. + 1.25 D. sph. ⊂ + 1.25 cyl. axis 102°

Vision obtained with correcting glasses has been 1.3 in each eye, throughout the whole time. The eyes still show accommodation = 0.25 D.

In 1890, among patients who had returned for changes of correcting glasses, the writer found seventeen other cases of increasing hyperopic astigmatism. The periods of observation varied from 2 to 8 years and the increase of astigmatism from 0.25 to 2.50 D. In only 2 of the 34 eyes was there no increase and for the whole series the amount of change averaged 0.75 D. Such changes of refraction are of great importance to those who read, do needle work, or who support themselves by mechanical work requiring accurate vision. Yet in the more than forty years that have elapsed since these cases were published, almost no attempt has been made to increase our accurate knowledge of such changes.

In 1862 when Helmholtz, Knapp, Donders[1], and others became interested in astigmatism, the ophthalmometer afforded an accurate scientific means of measuring the curvature of the corneal surface and it was natural that they should turn attention to laboratory measurements of corneas with this instrument. The ophthalmometer of Javal and Schiötz[2], proposed in 1881, made it practical to measure the corneal curvatures as a routine method of clinical examination; and in doing so, called general attention to astigmatism, as dependent on the differing curves of the cornea. It soon became evident that it did not depend wholly on the corneal curvatures, but they continue to be thought of as playing the most important part in causing astigmatism.

The effect of corneal sections in causing corneal astigmatism, including 44 cases of cataract extraction, and 4 cases of peripheral iridectomy for glaucoma,

was observed and reported to the first Pan-American Medical Congress, at Washington in 1893[3]. Such astigmatism appears immediately after closure of the corneal wound, and increases rapidly for several days, until it reaches its maximum; then gradually declines to an amount more or less permanent. This state is reached usually in three or four months, but may be reached in one month, or not for nearly a year. The meridian of greatest corneal curvature is roughly parallel to the direction of the center of the corneal section; and the meridian of least curvature approximately perpendicular to the section. The occurrence and character of such changes in corneal curvature seem to be fully explained by destruction of the resistance of the corneo-scleral coat along the line of section, and its slow and incomplete restoration by the process of healing. This explanation has been fully confirmed by the observation of cases seen since the presentation of that first paper. The behavior of nineteen eyes that have been studied recently in the same way, is indicated in Table 1.

Table 1

		Corneal Astigmatism			Correcting Lens	
Sex	Age	Before	Highest	Final		Time
F	76	1.75 cyl. 90°	5.50 cyl. 5°	4.00 cyl. 180°	10.50 ⊖ 2.00 cyl. 145°	3 yrs.
F	78	0.50 cyl. 90°	11.00 cyl. 20°	11.00 cyl. 25°	7.00 ⊖ 8.00 cyl. 15°	18 mo.
F	71	0.75 cyl. 90°	4.50 cyl. 160°	4.00 cyl. 160°	10.00 ⊖ 3.00 cyl. 155°	2
M	74	0.50 cyl. 90°	9.00 cyl. 180°	4.00 cyl. 180°	10.50 ⊖ 2.50 cyl. 170°	2 yrs.
F	74	5.50 cyl. 10°	6.00 cyl. 180°	5.50 cyl. 5°	12.00 ⊖ 3.50 cyl. 6°	10
M	65	3.00 cyl. 90°	10.00 cyl. 10°	5.00 cyl. 15°	8.50 ⊖ 4.00 cyl. 5°	5
M	67	3.00 cyl. 90°	13.00 cyl. 155°	4.50 cyl. 5°	10.50 ⊖ 1.50 cyl. 165°	3
M	74	No cyl.	12.00 cyl. 30°	8.50 cyl. 35°	8.00 ⊖ 6.00 cyl. 35°	16 mo.
M	55	0.75 cyl. 90°	10.00 cyl. 180°	8.00 cyl. 175°	9.00 ⊖ 3.00 cyl. 176°	13 yrs.
F	66	0.25 cyl. 70°	5.00 cyl. 180°	3.00 cyl. 180°	12.00 ⊖ 3.00 cyl. 180°	2
M	63	0.50 cyl. 45°	18.00 cyl. 150°	4.00 cyl. 152°	10.50 ⊖ 2.25 cyl. 155°	13
M	80	No cyl.	5.50 cyl. 30°	5.00 cyl. 30°	7.50 ⊖ 5.00 cyl. 30°	2
M	62	0.25 cyl. 180°	8.00 cyl. 155°	4.50 cyl. 150°	9.00 ⊖ 3.00 cyl. 157°	4
F	58	0.50 cyl. 90°	4.25 cyl. 145°	3.25 cyl. 140°	11.50 ⊖ 3.50 cyl. 140°	8
F	60	0.25 cyl. 90°	5.50 cyl. 10°	3.00 cyl. 10°	11.50 ⊖ 2.00 cyl. 10°	6
F	63	No cyl.	4.50 cyl. 160°	3.00 cyl. 170°	10.00 ⊖ 1.50 cyl. 165°	8 mo.
M	66	0.50 cyl. 100°	6.50 cyl. 25°	2.00 cyl. 20°	10.00 ⊖ 2.00 cyl. 22°	3 yrs.
F	56	5.00 cyl. 18°	3.50 cyl. 160°	1.50 cyl. 25°	10.00 ⊖ 4.00 cyl. 175°	14
M	68	No cyl.	4.50 cyl. 165°	3.00 cyl. 180°	10.00 ⊖ 3.00 cyl. 178°	6

The columns indicate: First, the sex and age of the patient; "Before," means the corneal astigmatism before the operation; "Highest," indicates the highest corneal astigmatism observed, usually a few days after closure of the corneal wound; "Final," is the amount of corneal astigmatism, when it has settled to the approximately permanent condition. "The Correcting Lens" is the one given for distant vision after the eye seems to be quiet, usually three to six months after the operation. The "Time" is the months, or years the patient remained under observation after operation, with no further change of corneal astigmatism.

In the second case the unusually high amount of permanent astigmatism, which remained until the patient's death after eighteen months, was probably due to a small prolapse of iris, which occurred a few hours after the operation, when the patient struck at a fly that lit on her face. All the other cases, in both series, were free from any such complication. The changes of corneal curvatures are a necessary consequence of the cataract operation, rather than of a certain placing of the section, or the usual complications that may occur.

The highest degrees and most sudden changes of corneal astigmatism, are those which occur in conical cornea;

and keeping the astigmatism accurately corrected is a very important part of the treatment of keratoconus. George E. de Schweinitz stated, a few years ago, he never operated for conical cornea; and that the optical treatment by glasses gives as good results as are reported from operation. This agrees exactly with the writer's experience. The astigmatism of these eyes must be tested, with the small pupils they will have by outdoor light, or with accommodation and strong convergence. The use of pilocarpin, to bring good contraction of the pupil, should be resorted to for such testing. The accurate correction of the astigmatism, that the eye actually has when in use, is just as important for the control of keratoconus as it is for the common form of progressive posterior, or axial myopia.

The degenerative changes that sometimes occur in the periphery of the cornea after middle life causes, in some cases, extensive grooves, or bulging, which are attended with changes in the astigmatism of the central visual zone. The correction of such astigmatism may greatly reduce the impairment of vision that would otherwise be ascribed to opacity, or fundus manifestations of senile decay. In former generations cases of poor vision after middle life were all ascribed to "presbyopia."

Thomas Young found that his own astigmatism of 1.50 D., which he called "normal astigmatism," was not due to the curvature of his cornea, but to the crystalline lens. The early observations with the ophthalmometer showed that the corneal curvature was not the only factor in determining the total astigmatism of the eye, but an important and evident factor. When it was proved that glasses could not be wisely prescribed by the ophthalmometric findings, many men lost interest in the clinical use of the ophthalmometer. Later experience has shown that the element of astigmatism caused by the lens, is quite as important as that caused by the cornea.

In his "Treatise on Astigmatism," published in 1887 by Swan M. Burnett[4], is given a table comparing the total and the corneal astigmatism in 15 cases —30 eyes. In one eye the difference was 1.00 D., and in 8 it was 0.50 D. Of these patients the majority were under 30 years of age, the time of life in which total and corneal astigmatism most nearly correspond. The most extensive statistics, published in the last five years, all show that after 30 years the total astigmatism is more and more influenced by the astigmatism caused by the crystalline lens.

The changes in corneal astigmatism produced by a corneal section, or occurring with the healing of a corneal injury or ulcer, could be studied in a few months, or at the latest within a few years, and were always a matter of direct observation. The changes of astigmatism occurring throughout the different periods of life were not complete for many years; and the astigmatism of the lens has never been made a subject of clinical measurement, but rather of inference. When the corneal astigmatism is known, and also the total astigmatism of the eye, the difference between the two could be attributed to the astigmatism due to the curvature and position of the lens.

As in Young's case it has been inferred by eliminating corneal astigmatism, or by measuring that and finding the difference between it and the total astigmatism of the eye, as determined by the usual clinical methods. On this account lens astigmatism shares the inexactness of ophthalmometric methods. The total astigmatism can usually be measured by skiascopy, and by subjective methods with an exactness leaving less than 0.25 D. of possible error. But for measurement of corneal curves with the ophthalmometer, we agree with Gullstrand[5] that, "As a usual thing the possible error may be estimated at between one-fourth and one-half diopter."

We have chosen (also following Gullstrand) to speak of as "vertical meridians," those exactly vertical, or within 30 degrees on either side of this position; as "horizontal meridians," those within 30 degrees of that position, and as "oblique," all meridians lying between. It is convenient to designate astigmatism as vertical, horizontal, and

oblique, according to the direction of the axis of a convex cylinder that would correct it. In a study[6] of "Changes in Refraction with Presbyopia," published in 1930, we found:

"The changes of astigmatism that occurred after forty years of age were observed in 434 eyes. They carried the eye from vertical to oblique astigmatism in 36 eyes, and from vertical to horizontal in 79 eyes. In 140 eyes the astigmatism changed, but not sufficiently to carry the eye into either the oblique or horizontal class. In 45 eyes that started with oblique astigmatism, it continued oblique in 20, and changed to horizontal in 25. Of 147 eyes that started with the meridian of greatest curvature horizontal, it continued horizontal in 145; and changed to oblique toward vertical in only two." "In no case was there a change in the corneal curvature corresponding to the change in the total astigmatism of the eye."

The studies published in the last three years, especially on the "Norms of Refraction[7]," and the "Share of the Crystalline Lens in Ocular Refraction[8]," have shown that changes in astigmatism are the most common and important changes in ocular refraction. A new study of 632 eyes, 316 patients, has been made, to determine more certainly what the changes are and when they occur. Its results are condensed in table 2. These patients who were under observation for periods varying from 5 to 53 years, have not figured in previous statistics. The corneal astigmatism has been determined by the ophthalmometer of Javal and Schiötz; the total astigmatism, equivalent to the "correction value" of Gullstrand, was measured by skiascopy, and the subjective testing with lenses, including the cross cylinder. The cases have been grouped by age, into decades up to sixty years, and those beyond sixty in a single group. The statistics observed through more than one decade are repeated in different groups. This causes the 632 eyes to furnish 1256 observations in table 2. But this total would be still more increased, if all intermedi-

Table 2

CORNEAL ASTIGMATISM

Ages	Vertical Astigmatism	Horizontal Astigmatism	Oblique or No Astigmatism	Total Eyes
Under 10	93 percent	0 percent	7 percent	28
10–20	86 "	5 "	9 "	136
20–30	89 "	3 "	8 "	232
30–40	86 "	4 "	10 "	260
40–50	83 "	5 "	12 "	285
50–60	80 "	8 "	12 "	167
Over 60	74 "	9 "	17 "	148
				1256

TOTAL ASTIGMATISM

Ages	Vertical Astigmatism	Horizontal Astigmatism	Oblique or No Astigmatism	Total Eyes
Under 10	55 percent	14 percent	31 percent	29
10–20	64 "	12 "	24 "	128
20–30	58 "	14 "	28 "	216
30–40	56 "	21 "	23 "	281
40–50	38 "	32 "	30 "	257
50–60	17 "	48 "	35 "	189
Over 60	20 "	53 "	27 "	156
				1256

ate observations were included. The opportunity to study changes in refraction, over such long periods, is unusual enough to justify this presentation of them. An outstanding fact from such a study is that corneal astigmatism, in eyes free from local corneal disease, remains much the same throughout life. The second half of table 2—Total or Clinical Astigmatism—including the cases followed through different decades, shows that vertical astigmatism ("astigmatism with the rule"), which was 93 percent in the few cases under 10 years of age, gradually decreased; but remained 74 percent after the age of sixty. The horizontal corneal astigmatism ("against the rule"), beginning with 7 percent before 10 years of age, never rose above the 9 percent shown after sixty years.

Rather striking changes of corneal astigmatism occur when the astigmatism is of high degree. These are usually in the direction of decrease, which is more common than increase. This may be explained, like the astigmatism following corneal sections for cataract by the continuous action of intraocular pressure, tending to make the curvature of the resisting cornea approach, more and more nearly, the curvature of a sphere. The slight diminution of corneal astigmatism with age, which shows in this table, and has been noticed before, may be associated with an increased intraocular pressure that sometimes appears in later life, without any other manifestation of glaucoma.

Total, or clinical astigmatism, the distortion of pencils of light that have passed through all the dioptric surfaces and media of the eye, can be measured more accurately and certainly than the corneal surfaces examined with the clinical ophthalmometer. But granting them equal meaning, a comparison of the two shows clearly the greater frequency and amount of the changes in the clinical, or total astigmatism.

To bring out the frequency and great importance of changes of astigmatism, it was necessary to assemble and tabulate large numbers of cases; and especially of cases observed over long periods. Of 72 eyes under observation more than twenty-five years, only 18 showed less than 0.50 D. of change in astigmatism. A series of typical cases, in which the changes were watched from 4 to 30 years, gives a more definite conception of when such changes are most likely to occur, and how they should be looked for and corrected (see table 3).

As a rule, corneal astigmatism does not change. The apparent changes indicated above are generally slight. The whole of them averages less than 0.50 D. and this is within the limits of possible error in single readings. The corneal curves vary in each meridian. Gullstrand reported that a variation of less than 10 degrees in the direction of fixation, made a difference in the corneal curve corresponding to one-half diopter. His measurements were made on eyes trained to accurate fixation. In the clinical examination of a patient untrained to fixing the direction of his gaze, it easily wanders enough to make such changes in the reading of the instrument. In case 1, there were paretic anomalies of ocular movement that explain the variation in the curves and meridians of the right eye.

In the early period, the first three decades, there were some slight increases of corneal astigmatism (cases 1, 2, and 5), that might well be ascribed to developmental changes, which account for the cases of increased hyperopic astigmatism. Toward the end of life there was a tendency to slightly decreased astigmatism (case 7 after 40; and case 14), that could be due to the tendency of intraocular pressure to bring about a more perfectly spherical shape of the cornea. In a very few cases there were marked changes in the corneal curvature, that were not recognized as belonging to keratoconus, or to other local corneal disease. But as a rule the corneal astigmatism is constant throughout life. Certainly there are no changes in it that account for the common changes in the correcting cylinders required.

Total, or clinical astigmatism, on the other hand, does show changes that cannot be explained by any changes in

Table 3

	Sex	Age	Corneal Astigmatism		Correcting Cylinder	
			Right	Left	Right	Left
1	M	10	0.50 cyl. 90°	0.50 cyl. 70°	1.25 cyl. 150°	0.75 cyl. 25°
		16	1.00 cyl. 125°	0.50 cyl. 30°	1.25 cyl. 60°	2.00 cyl. 2°
		19	1.00 cyl. 125°	0.50 cyl. 30°	1.25 cyl. 60°	2.00 cyl. 2°
		22	1.50 cyl. 120°	0.25 cyl. 30°	1.00 cyl. 105°	1.37 cyl. 3°
2	F	10	1.12 cyl. 85°	1.12 cyl. 92°	0.50 cyl. 90°	0.50 cyl. 85°
		28	2.00 cyl. 90°	1.75 cyl. 90°	1.00 cyl. 74°	1.00 cyl. 85°
		38	2.00 cyl. 90°	1.75 cyl. 90°	1.37 cyl. 67°	0.75 cyl. 95°
		51	2.00 cyl. 90°	2.00 cyl. 90°	0.87 cyl. 45°	0.37 cyl. 50°
3	F	18	0.50 cyl. 90°	0.75 cyl. 80°	0.25 cyl. 85°	0.37 cyl. 90°
		28	0.25 cyl. 90°	0.75 cyl. 90°	0.62 cyl. 10°	0.25 cyl. 125°
		38	0.50 cyl. 90°	0.50 cyl. 90°	0.75 cyl. 5°	1.00 cyl. 3°
		41	0.50 cyl. 90°	0.50 cyl. 90°	1.50 cyl. 5°	1.37 cyl. 178°
4	M	21	0.50 cyl. 100°	0.50 cyl. 100°	0.	0.37 cyl. 155°
		26	0.75 cyl. 95°	0.75 cyl. 105°	0.37 cyl. 110°	0.62 cyl. 155°
		47	0.50 cyl. 95°	0.25 cyl. 95°	0.25 cyl. 170°	0.75 cyl. 140°
		59	0.50 cyl. 90°	0.50 cyl. 90°	2.75 cyl. 180°	1.00 cyl. 155°
5	F	21	0.75 cyl. 90°	1.00 cyl. 90°	0.62 cyl. 90°	0.87 cyl. 88°
		31	1.50 cyl. 85°	2.00 cyl. 85°	0.87 cyl. 75°	1.00 cyl. 80°
		35	1.25 cyl. 90°	2.00 cyl. 90°	0.75 cyl. 50°	1.12 cyl. 75°
		51	1.00 cyl. 90°	2.00 cyl. 90°	1.00 cyl. 180°	0.75 cyl. 25°
6	M	25	0.50 cyl. 90°	3.25 cyl. 50°	0.37 cyl. 110°	3.25 cyl. 48°
		37	0.50 cyl. 100°	3.00 cyl. 45°	0.	1.50 cyl. 15°
		51	0.25 cyl. 90°	3.00 cyl. 45°	0.37 cyl. 15°	2.25 cyl. 5°
7	M	27	0.50 cyl. 95°	1.00 cyl. 85°	0.62 cyl. 85°	0.37 cyl. 90°
		33	0.75 cyl. 90°	0.75 cyl. 90°	0.62 cyl. 55°	0.37 cyl. 105°
		39	1.00 cyl. 90°	0.50 cyl. 70°	0.75 cyl. 55°	0.37 cyl. 135°
		42	1.00 cyl. 90°	0.50 cyl. 45°	1.00 cyl. 35°	0.37 cyl. 150°
		52	0.50 cyl. 100°	0.50 cyl. 80°	1.00 cyl. 35°	0.50 cyl. 155°
		57	0.50 cyl. 100°	0.50 cyl. 85°	1.37 cyl. 35°	0.50 cyl. 165°
8	F	32	1.50 cyl. 90°	2.50 cyl. 90°	1.00 cyl. 92°	2.00 cyl. 85°
		41	1.50 cyl. 90°	2.25 cyl. 90°	1.12 cyl. 90°	2.75 cyl. 78°
		52	1.50 cyl. 90°	2.25 cyl. 90°	0.87 cyl. 87°	1.75 cyl. 85°
		62	1.75 cyl. 90°	3.00 cyl. 90°	0.87 cyl. 88°	1.25 cyl. 73°
9	F	34	1.00 cyl. 90°	1.00 cyl. 90°	0.	0.25 cyl. 100°
		39	1.25 cyl. 90°	1.25 cyl. 90°	0.	0.37 cyl. 150°
		56	1.00 cyl. 90°	1.00 cyl. 90°	0.37 cyl. 10°	0.50 cyl. 35°
10	M	36	1.25 cyl. 90°	4.00 cyl. 105°	0.	3.50 cyl. 112°
		42	1.00 cyl. 90°	4.50 cyl. 105°	0.37 cyl. 3°	2.50 cyl. 118°
		58	1.00 cyl. 90°	5.00 cyl. 90°	0.75 cyl. 3°	3.50 cyl. 107°
11	F	36	1.25 cyl. 80°	1.25 cyl. 100°	0.62 cyl. 90°	0.75 cyl. 105°
		48	1.25 cyl. 90°	1.25 cyl. 90°	0.25 cyl. 85°	0.25 cyl. 95°
		66	1.25 cyl. 90°	1.00 cyl. 90°	0.25 cyl. 22°	0.37 cyl. 157°
12	M	46	2.00 cyl. 85°	2.50 cyl. 155°	0.50 cyl. 80°	3.00 cyl. 165°
		48	2.00 cyl. 80°	3.00 cyl. 155°	1.25 cyl. 72°	4.50 cyl. 160°
		50	2.00 cyl. 80°	3.00 cyl. 155°	1.25 cyl. 80°	4.25 cyl. 165°
13	F	46	5.50 cyl. 90°	5.00 cyl. 90°	5.50 cyl. 87°	5.50 cyl. 112°
		51	5.50 cyl. 90°	5.50 cyl. 90°	5.00 cyl. 90°	5.00 cyl. 105°
		60	5.50 cyl. 90°	5.50 cyl. 100°	5.00 cyl. 88°	5.00 cyl. 100°
14	F	49	0.50 cyl. 90°	0.75 cyl. 90°	0.	0.
		54	0.50 cyl. 90°	0.50 cyl. 90°	1.00 cyl. 175°	1.00 cyl. 5°
		71	0.50 cyl. 90°	0.50 cyl. 90°	1.25 cyl. 178°	1.50 cyl. 178°
15	F	54	0.50 cyl. 90°	0.50 cyl. 90°	0.	0.
		66	0.50 cyl. 90°	0.50 cyl. 90°	0.	0.
		79	0.50 cyl. 90°	0.50 cyl. 90°	0.75 cyl. 30°	0.37 cyl. 180°

the corneal curves. All extensive statistical studies show that the meridian of greatest refraction is nearly vertical in early life, and more generally nearly horizontal in the later decades of life[8]. That what has been called "astigmatism with the rule," "direct astigmatism," corresponding to corneal astigmatism, ceases to be "with the rule," becomes "inverse" or "reverse astigmatism" in later life. Reasoning by exclusion it is evident that such changes in astigmatism must depend on changes in the crystalline lens. As with other structures of epithelial origin, it has been proved that the crystalline lens continues to grow until near the end of adult life. Such changes may be associated with development of senile cataract, but may be recognized when the lens is free from cataract, or from any departure from the normal.

Although the lens appears in early embryonic life, it continues to develop rapidly after birth. The studies made of accommodation seem to show that it does not reach its maximum influence until near puberty, at about 10 to 16 years of age. By skiascopy we can observe changes of lens refraction that may continue so long as the lens remains clear. Lens changes are worthy of study by biomicroscopy. They are of great practical importance through the changes of astigmatism now known. Lack of symmetry in the "zones of discontinuity" should be carefully sought for, and their relations to these senile changes in astigmatism. Changes of regular astigmatism should be carefully discriminated from the other causes of impaired vision that have been confused under the name "presbyopia." Such changes are illustrated by cases 3, 7, 11, 12, and 14. They are also dwelt upon in former papers[7, 8]. The time of life when loss of accommodation makes correcting lenses most important, is a time when our patients *should not* be turned over to the mercy of the spectacle salesmen.

Attention was called by de Schweinitz[9], to the greater frequency of astigmatism against the rule, after forty years of age. In 1891 he reported one hundred cases of this condition, 30 percent of which was in patients under 40 years of age, while 70 percent was in patients over that age. Before that time, the idea that astigmatism was congenital and did not often change, except by local disease or injury of the cornea, was held by Donders, and had been dominant in the literature. Other statistics by Bennett and Clemensha[10], Zentmayer[11], and Steiger[12] did not suggest (but did not oppose) radical changes of astigmatism with age. This was announced in 1918 in a paper presented to the Section on Ophthalmology of the American Medical Association[13]. In that paper the following conclusions were reached:

"The facts before us demonstrate that astigmatism is likely to change at any period of life. In childhood it frequently increases because of the increased asymmetry of the anterior surface of the cornea. Such change is usually in the direction of the relatively greater curvature in the vertical meridian. It may occur at any time of life.

"In childhood also, the astigmatism sometimes changes because of changes in the other dioptric surfaces of the eye; and changes due to this cause become more and more frequent as time goes on. Such changes cause astigmatism 'with the rule' to become the exception in the latter part of life, and its opposite the rule. This fact makes these generally understood terms entirely inappropriate, and they should be replaced by others, such as: direct, with the meridians of greatest curvature approximately vertical; inverse, with the meridians of greatest curvature approximately horizontal; and oblique, in the same sense in which it is used above.

"Astigmatism is congenital chiefly in the sense that a tendency to asymmetrical refraction exists, which works itself out at some stage in the development of the person. The variety of the changes that may occur in astigmatism points to the interplay of a number of factors yet to be studied. The fact that a large majority of eyes undergo these changes to an extent that gives them practical importance, makes it imperative that the astigmatism shall be remeasured

whenever symptoms arise that may be due to uncorrected astigmatism."

The failure to accept these views, in any important textbook on ophthalmology, or ocular refraction, seems to call for restudies of the subject which has been reported in this paper, and others published in the last five years. It cannot be hoped that astronomers, mathematicians, lens manufacturers, and those who sell lenses, will discover, or appreciate, facts revealed only by the records of clinical experience. Their importance to an understanding of many ophthalmic and nervous conditions as well as to success in ophthalmic practice and the service of the public demand that they be now understood, accepted, and accorded their therapeutic significance.

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THE USE OF CALCIUM GLUCONATE IN DISEASES OF THE EYE

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The action of calcium gluconate is similar to that of calcium chloride but less toxic. In powder form it is tasteless and nonirritating to the intestinal tract. Subcutaneous injections do not irritate the tissues. It has been found to be very effective in phlyctenular disease and in certain types of uveitis, but in the allergic eye conditions the results of this therapy have not been consistent. The results are given in 24 cases of inflammatory ocular disease. Read before the Chicago Ophthalmological Society, February 20, 1933.

In dealing with inflammatory conditions the ophthalmologist is aware that his first duty is the determination of the cause. Tuberculosis, lues, or distant foci of infection may be responsible. The difficulties of etiological studies are great and usually it takes time before determination of any significance can be obtained. In a certain number of cases the problem cannot be solved. In his study of 500 cases of iridocyclitis, Gilbert[1] reports 17.4 percent due to unknown causes.

To combat the pathological process by increasing the general and local resistance to inflammatory reactions and to relieve pain, there is a call for nonspecific therapy. For this purpose calcium has to be considered. Its use is based upon the following facts:

A. E. Wright[2] found that the local edema caused by the injection of virulent vaccine can be checked by the injection of calcium chloride. Stimulated by the work of Wright and other authors, Chiari and Januscke[3], using rabbits, caused enormous edema and inflammation of the conjunctiva by instillation of mustard oil or abrin solution. In animals, which were previously injected with calcium chloride, the inflammatory irritation of the mustard oil was minimal, or there was no swelling at all. Inhibition of exudate occurs 2 or 3 hours after injection and lasts 48 hours.

With the same method, S. Herman and M. Zentner[4] were able to show that susceptibility of tissue to inflammation varied inversely with the amount of diffusible calcium in the blood. The activity of the calcium ion at the site of the inflammatory process is usually described as (a) increased phagocytic and motile activity of the leucocytes (Hamburger[5], Tunnicliff[6]), (b) decreased permeability of blood vessels and lining membranes, and (c) diminished sensitiveness of the vegetative nervous system (sympathetic and para-sympathetic).

A good illustration of the latter factor, is the influence of direct calcium deprivation on the eye by instillation of 3 percent sodium oxalate, which precipitates the calcium as insoluble calcium oxalate. When this is done on cats' eyes, maximal miosis occurs, which does not yield to darkness. Chiari and Frölich[7] assume that the drop in the calcium content of the tissues of the eye increases the sensitiveness of the peripheral para-sympathetic nerve endings to such an extent that the normal central tone brings about a maximal miosis. From these experiments, it does not seem too far-fetched to assume that an abnormally high content of calcium ions in the eye will desensitize the sphincter and make it more easily accessible for paralyzing drugs (atropine).

Local application was also tried by Leo[8] to determine the possible inhibitory effect on the reaction to mustard oil. He observed the same reduction of inflammatory reaction when the calcium was instilled into the eye or given by mouth.

In any attempt at calcium therapy, it must be considered that calcium is one of the most wide-spread elements in nature and is a normal and important constituent of animal and plant tissue. The functional activity of nerve and muscle cells depends on its presence and is markedly influenced by any deficiency or excess. Permeability of cells and capillaries is increased by lime deficiency and decreased by lime excess.

The therapeutic uses of lime salts closely follow their physiological effects. They are of great value in certain bone defects and in conditions associated with increased permeability of the capillaries, such as urticaria and hay-fever. Calcium is so necessary to normal balance that we may overlook its usefulness as a therapeutic measure.

In the blood, calcium is found in the free diffusible form (also called pharmaco-dynamic calcium) which is capable of passing through capillary wall and cell membrane, and the nondiffusible form which is found in combination with protein. Depending upon whether the whole blood, or filtrates after precipitation of the blood proteins are used, the total or the free calcium content is obtained. If ionized calcium is injected intravenously or intramuscularly, the striking fact is observed that only about 25 percent of the injected calcium is actually found in the circulating blood. The rest apparently enters the tissues and, within the course of two days, is finally excreted through the blood stream into the urine and feces (Dadlez[9], Weese[10]).

The proportion of the free to the total calcium remains constant during these experiments and only the absolute amount of diffusible calcium is very slightly increased (Schuntermann[11]). The absorption of calcium given by mouth is always very incomplete, probably because of the formation of the carbonate and other insoluble compounds.

The following calcium preparations are in current use:

1. Calcium chloride, or muriate of lime, contains not less than 75 percent of $CaCl_2$. By mouth it is given in doses of 5 to 30 grains. It has a sharp saline taste and is very irritating to the intestinal tract unless greatly diluted. Great care must be exercised when using it intravenously. Outside of the veins, it produces a very painful irritation with induration and possible abscess and sloughing.

2. Calcium chloride urea, or afenil, is a molecular compound of calcium chloride and urea, with the properties of calcium chloride. The dose is 10 c.c. of 10 percent solution, intravenously. Mayer[12] warned against its use for intra- or subcutaneous injection. Under aseptic conditions, he injected 0.2, 0.4, 0.6, 1.0 and 2.0 c.c. of afenil intra- and subcutaneously into 4 rabbits. The last two doses produced inflammation and necrosis.

The objections to calcium chloride have been overcome by the recently introduced preparations of calcium gluconate. This compound has been accepted by the Council on Pharmacy and Chemistry of the American Medical Association for admission to new and nonofficial remedies*. It is the calcium salt of gluconic acid, an oxidation product of glucose, and contains 9.3 percent of calcium. Its action is similar to that of calcium chloride. It is a white, tasteless powder and nonirritating to the intestinal tract. It may be dissolved in milk or other fluid, and is given in level or heaping teaspoonful doses. Rothlin[13] has shown experimentally that it is less toxic than chloride. It is less irritating for intravenous injection. Calcium gluconate has the advantage over other calcium salts that it may be given subcutaneously without local irritation. Lieberman and Szurek[14] found that calcium gluconate can be given subcutaneously in large amounts without causing necrosis, even when injected daily in the same region of the body. Given intramuscularly, the action of calcium gluconate is slower and prolonged. A 10-percent solution is dispensed in 5- and 10-c.c. hermetically sealed ampules for injection.

The use of calcium in eye therapy appeared in the literature in 1905. At that time, Lewin and Guillery[15] reported the use of calcium chloride in eye diseases, by instillation of a 2- to 4-percent solution into the conjunctival sac. We now know that their method could not be successful, because calcium is effective only in large doses and by slow absorption.

In 1913, Dutoit[16] reported the use of internal calcium therapy in eczematous and scrofulous eye diseases. He used kalmopyrin, a compound of calcium and

* New & Non-official Remedies 1931, p. 112.

acetylsalicylic acid, continued over periods of 2 to 3 months. He found the general health improved as well as the eye condition. Several cases of phlyctenular disease were cured without local treatment.

During the war, the lack of calcium in the food brought on many "Oedem" diseases, especially in children, in dangerous forms of kerato-conjunctivitis. Wessely[17] found that various calcium salts had a good influence on these cases, especially when given frequently in small oral doses. His report stimulated calcium therapy throughout Europe.

In 1920 Leo[8], not satisfied with the use of calcium internally, used calcium chloride intravenously. He was not satisfied with this form of treatment as the effect was too fleeting.

From 1921 to 1926 many reports were made on the use of afenil in eye diseases. Egtermayer[18], using afenil intravenously, found it of no avail in vernal catarrh, but of great use in hay-fever conjunctivitis. Clausen[19] produced temporary relief from subjective symptoms in vernal catarrh and none in hay-fever or phlyctenular disease. Horvat[20] and Abramowicz[21] had slight improvement in vernal catarrh, while Gala[22] said it is of no avail even in large doses. DeRosa[23] found that intramuscular injections of afenil in vernal catarrh, given every other day, always brought subjective and objective improvement. Arlt[24] in his report of the use of afenil in 23 cases of phlyctenular eye conditions, states that in severe cases, one injection reduced blepharospasm and conjunctivitis markedly. Repeated injections produced lasting cures.

In 1930, Kuprijanova's[25] report of 28 patients treated with intravenous injections of calcium chloride, showed good results in 11 cases of uveitis. Her record shows: 11 cases of tubercular uveitis, 2 cases of scrofulous blepharitis, 5 of sympathetic ophthalmia, 2 of acute simple glaucoma, 2 of episcleritis, 5 of uveitis, and 1 of detachment. She quotes a striking case of sclerosing keratitis.

In 1930, Herrold[26] reported the favorable influence of calcium gluconate in a severe iridocyclitis which was metastatic to a gonorrheal prostatitis. It was a rapidly progressive inflammation. The pupil was bound down and occluded so that the patient could not perceive objects. Atropine was ineffective. Six hours after the second intravenous injection and within 48 hours, the patient could outline fingers at one foot. Within five days, the exudate in the anterior chamber was almost completely absorbed.

Cremer[27], working in Wessely's clinic, studied calcium therapy for a period of two years in the treatment of phlyctenular conjunctivitis in children. He took 150 children and divided them into two equal groups of seventy-five each. One group received the ordinary treatment and the other, ordinary treatment plus calcium gluconate. The comparative results were estimated by the number of days the patients had to stay in the hospital. The cases without calcium remained on an average of 22.5 days; those treated with calcium only 14.1 days—a shortening of one third in the period of hospitalization. Cremer also studied the influence of calcium upon the frequency of recurrence. There were 8 percent of recurrences in patients treated with calcium and 14 percent in those not treated with calcium. He found that calcium not only improved the eye condition but the general health also. He gave calcium gluconate, level or heaping teaspoonfuls, three times a day and, like Wessely, found that small frequent doses were preferable to larger doses.

Stajduhar[28] recommended calcium gluconate by mouth, intravenously or intramuscularly in cases of vernal catarrh and phlyctenular disease.

Sefic[29] observed good results in 217 patients with phlyctenular disease, all of whom had the fibrous type of tuberculosis of the lung. Calcium chloride was used by injection, 20 to 30 injections being given every other day, beginning with 10 and going up to 15 percent, 5 c.c. each. A striking effect was obtained in blepharitis. The patients gained in weight.

Based upon the results of Smorodizen, who found increased phagocytosis with a low potassium calcium quotient, Na-

zarov[30] used 5 to 10 c.c. of 10 percent calcium chloride, altogether 8 to 12 injections. Treatment was very useful if combined with local and etiological treatment in iritis and phyctenular lid and corneal diseases of children. There was no definite effect in glaucoma.

F. P. Fischer[31] saw a very striking clearing of the vitreous and improvement of vision after large doses of calcium chloride (in syrup by mouth); average dose, 1 to 2 grams of calcium chloride per day. The disadvantage is the requirement of large amounts and the bad taste.

Duschnitz[32], using calcium therapy in 250 cases, found marked improvement in phlyctenular disease, also in uveitis of tubercular or rheumatic origin. In uveitis of other origin, he found a welcome analgesic effect. There was no effect in glaucoma.

Friedman[33] repeated Cremer's experiment with phlyctenular conjunctivitis and had similar results, showing that pain and hypersensitiveness disappeared when calcium was used. He observed that calcium by mouth acted quicker in children than in adults.

From the various, sometimes rather sketchy, reports on calcium therapy, it can be surmised that it is very effective in phlyctenular disease and in certain types of uveitis. Its effect is inconsistent and doubtful in the allergic eye diseases. From its pharmacological characteristics, it could be expected to shorten and mitigate the course of certain inflammatory diseases and to favor prompt response to sphincter-paralyzing drugs.

The following observations seem to justify these expectations:

On Dec. 27, 1929, C.J., male, aged 22 years, gave a history of not having been able to see well with the left eye for two months. He had neither pain nor headache, but at times the eye was slightly red. Vision: O.D. 20/15, O.S. fingers at two feet. There were slight ciliary injection; large mutton-fat deposits on the posterior surface of the cornea, arranged in pyramid formation; and turbid aqueous. The pupil, 3 mm. in diameter, did not react, the iris pattern was blurred, the vitreous cloudy, obscuring the fundus. He was husky, well-nourished, and active in spite of two ears that had discharged since childhood. He had a slightly positive tuberculin reaction. His physician discouraged tuberculin treatment. Six weeks of treatment with atropine, hot applications, and milk injections three times a week, dilated the pupil, but did not lessen the deposits on the cornea or the turbidity of the aqueous.

On Feb. 4, 1930, calcium gluconate was given intravenously and repeated every 2 to 3 days. Nine days later, the precipitates on the posterior corneal surface were decreased in number, the aqueous and vitreous were less turbid, and the fundus vessels were visible for the first time. Vision, O.S., was 20/100.

The calcium was then given intramuscularly twice a week. Duschnitz reports the favorable action of calcium gluconate in a case of uveitis where foreign protein treatment was of no avail.

The second patient, Miss A. E., aged 33 years, on Dec. 5, 1929, gave a history of having had severe pain in the left eye for one week, headache, tearing, and photophobia. Both lids were swollen, the conjunctiva, both palpebral and bulbar, was edematous; exudates were on the posterior surface of the cornea; the aqueous was cloudy, iris discolored and blurred, the pupil contracted and filled with exudate. Vision, O.S., was moving objects. Atropine had been used for three days. The patient had an acute exacerbation of a chronic rheumatic fever, with which she suffered from childhood, and was bed-ridden. In addition to more frequent instillations of atropine and hot applications, intramuscular injections of 10 c.c. of 10 percent calcium gluconate were prescribed, and given by her family physician daily for four days, with increasing intervals as the condition improved. The doctor reported that pain in the eyes and head abated two hours after the first injection and disappeared within two hours after the second injection. The third day the pupil dilated. I saw her again on January 10, 1930, when the eye was entirely clear; a posterior synechia at "9 o'clock" remained. On the 24th,

vision in the left eye was 20/20. She walked and used her arms better than she had for years.

She has since had offending teeth and tonsils removed and has had no recurrence of rheumatism or iritis.

Encouraged by the action of calcium in the above cases and by Dr. Herrold's report, I used calcium gluconate in 24 additional cases where the uveal tract was primarily or secondarily involved.

All patients were referred by physicians and after the eye examination, were sent back for a thorough physical examination and aid in uncovering the etiology of the eye disease.

The following table shows the diagnosis, number of cases, sex, and probable etiology:

Disease	No. of Cases	Sex		Probable foci of infection					
		Male	Female	Teeth	Rheumatism	Chronic otitis media	Followed Injury	Vaginitis	Prostatitis
Chronic Uveitis	11	5	6	9	1	1		1	
Chronic Recurring Uveitis	4	2	2	2				1	1
Acute Uveitis	7	3	4	3	2		2		
Recurrent Superficial Corneal Ulcers	3		3	2				1	
Recurrent Herpes of Cornea	1		1	?					
Total	26	10	16	16	3			3	

Some patients had several possible sources of infection. In a number, bad teeth were accompanied by questionable tonsils, and in the rheumatics, both of these conditions were observed. Two cases of chronic uveitis had a slightly positive tuberculin reaction, but no active or healed focus could be found.

In most of these cases, the eye pathology had existed three days to one month, and each one had had the benefit of the orthodox treatment of atropine, heat, and elimination.

This treatment was continued and, in addition, calcium gluconate was given. The rational of treatment was as follows: 10 c.c. of the 10 percent solution were given intramuscularly every 24 hours until the acute symptoms subsided. The interval between injections was lengthened from two to four days. When the patient could not return daily for injections, a heaping teaspoonful of calcium was given orally, three times a day.

The striking results were:

1. Cessation of pain, usually two hours after the first injection; in very severe cases, after the second injection.

2. The definite rapidity of absorption of exudates, breaking down of adhesions, and dilatation of the pupil.

3. The improvement in the general health was very definite; patients gained in weight and acquired a feeling of well-being.

It was necessary to remove as thoroughly as possible all foci of infection. Where this was not done, after the first general improvement, progress was retarded or there would be recurrent attacks, which required more frequent doses of calcium and finally the removal of these foci. This was proved by the patient in the first case quoted, whose foul discharging ears yielded slowly to treatment. He eventually developed a cataracta complicata.

The course of the recurrent corneal ulcers was shortened with calcium therapy. In January, 1932, Mrs. C. gave a history of recurrent marginal corneal ulcers. Apical abscesses of two teeth were found by x-ray and these teeth were removed. Atropine and heat were

used. The course of the disease was ten weeks. In January, 1933, Mrs. C. had another recurrence. In addition to the use of atropine and heat and the removal of another diseased tooth, calcium gluconate was administered intramuscularly and orally. The attack was limited to four weeks.

Since January, 1924, Mrs. S. has had five attacks of herpes of the cornea. The average length of time of each of four attacks was six weeks. During the last attack, in conjunction with atropine locally, calcium gluconate was used intramuscularly and orally. The patient was more comfortable and the cornea healed in less than four weeks.

Conclusions

In treatment of inflammatory diseases of the eye, the administration of calcium salts, especially calcium gluconate intramuscularly,

1. Quickly ameliorates pain;
2. Hastens the absorption of exudates from the anterior chamber and vitreous;
3. Favors prompt response of the pupil to atropine;
4. Shortens the course of the inflammatory process.

It should be used in conjunction with other recognized measures, such as, local treatment, specific general remedies, and the elimination of focal infections.

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VERY HIGH ASTIGMATISM IN KERATOCONUS AND POST-CATARACT CASES

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Seven cases of high astigmatism in which cylinders were described and worn with comfort, are described. Read before the Saint Louis Ophthalmic Society, November 25, 1932. From the Department of Ophthalmology, Washington University.

Probably many highly astigmatic lenses have been prescribed and worn, but the number of cases reported in the available literature is rather limited. It is the purpose of this paper to record seven such cases, including several in which conical cornea was the underlying condition and some in which the astigmatism followed the extraction of cataract.

Dodd[1] in 1896 reported a case of corneal distortion from trachomatous scars in which a mixed astigmatic lens of 28 D. was fitted by use of the keratometer. This instrument showed a refraction in the horizontal meridian of 60 D. or an excess of 17 D. while the vertical meridian had a refraction of 32 D. or a deficiency of 11 D. from the average normal 43 D. The correcting lens of —12.00 D. cyl. axis 95° ⊂⊃ +16.00 D. cyl. axis 5° improved the visual acuity from 1/30 to 1/2.

March[2] reported a case of compound myopic astigmatism in which the correction was estimated by use of the skiascope. The lenses were: R., —12.00 D.sph. ⊂⊃ —12.00 D. cyl. axis 7½°; L., —12.00 D.sph. ⊂⊃ —14.00 D. cyl. axis 157½°. The visual acuity was improved from 3/200 and 5/200 to 20/50 and 20/40 in the right and left eyes, respectively.

Wescott and Pusey[3] reported a case in which the skiascopic correction with cycloplegia was: R., —13.00 D.sph. ⊂⊃ —7.00 D. cyl. axis 180°; L., —13.00 D.sph. ⊂⊃ —9.00 D. cyl. axis 180°.

In the subjective test under cycloplegia the result was: O.D., —3.00 D.sph. ⊂⊃ —2.50 D. cyl. axis 180°; V. = 6/15; O.S., —6.50 D.sph. ⊂⊃ —6.00 D. cyl. axis 170°; V. = 6/15.

When tried subjectively without cycloplegia the best results were as follows: O.D., +4.00 D. cyl. axis 150°; V. = 6/15; O.S., +6.50 D. cyl. axis 150°; V. = 6/15. The convex cylinders were worn with comfort.

Millikan[4], 1911, gives notes on a case he had followed twenty years. The man, aged 39 years in 1891, had a high degree of mixed astigmatism. The corneas were clear centrally with marginal opacities resembling arcus senilis. The vision was, right eye, 3/60; left eye, 4/60. The correction was determined by the use of the ophthalmoscope and lenses prescribed as follows: O.D., —10.00 D. cyl. axis 90° ⊂⊃ +7.00 D. cyl. axis 180°; V. = 6/9; O.S., —6.00 D. cyl. axis 100° ⊂⊃ +4.00 D. cyl. axis 10°; V. = 6/9.

Twenty years later after several changes during the period he required: O.D., —16.50 D. cyl. axis 100° ⊂⊃ +12.50 D. cyl. axis 10°; V. = 6/9; O.S., —8.50 D. cyl. axis 100° ⊂⊃ +8.50 D. cyl. axis 10°; V. = 6/9.

In this time his astigmatism had increased in the right eye from 17 D. to 29 D. and in the left eye from 10 D. to 17 D. He had been able to do a large amount of close work with comfort during these years.

Schneideman[5] in 1899 in reporting a case of very high astigmatism says, "in irregular astigmatism a clue to the direction of the axes may be derived by observing the changes in the principal axes of the elliptical nerve head as seen by direct and indirect ophthalmoscopy. The ophthalmometer may indicate the amount of difference between the principal meridians. Skiascopy will give these indications in the midst of the broken reflex by the general trend of light. Subjective examination is gener-

ally unsatisfactory if used alone." Speaking of the general reluctance on the part of ophthalmologists to prescribe strong lenses he says, "the disturbing effects of strong spherical lenses also inhere in strong cylinders; . . . such distortion will prove more or less annoying but the question is not whether the full and entirely comfortable vision of the normal eye can be obtained but whether the individual can be aided to a marked degree."

His case was that of a man aged 32 years whose vision was 12/100 in each eye; his correction, +2.0 D.sph. ⊂⊃ —20.00 D. cyl. gave 12/30 and 12/40 vision in the right eye and left eye, respectively. He had no asthenopic symptoms and wore the glasses constantly with comfort.

Mr. J. C. Copeland speaks of fitting a glass in a case of corneal scars from gunshot wounds, with optical iridectomy, by using the retinoscope at a distance of 5 inches from the eye. With this lens, +5.00 D.sph. ⊂⊃ + 10.50 D. cyl., the vision was improved from hand motion to 3/100.

These reports are reviewed to indicate the various methods employed in estimating the refraction in these difficult cases and the high corrections that have been prescribed.

The method used in the cases about to be reported was almost wholly subjective. In part of them some indications were secured by the ophthalmoscope, keratometer and skiascope as to the character of the error and direction of the axes. Cycloplegia was rarely helpful and always the final result was determined without its use or after its influence had passed. Patience and persistence in both patient and examiner are required for prolonged and repeated trials are necessary.

In all cases an ordinary trial case with spheres up to 20 diopters and cylinders to 8 diopters and a three-cell mechanical trial frame was the only equipment employed. The patient was seated at the test range after various objective devices had shown the nature of the error as far as possible. A test card with large letters was set up at the greatest distance at which the largest letter could be seen. If a strong spherical lens could be found which improved the vision a little, it was placed in the frame and the card moved back as far as the largest character could be recognized. After the best sphere had been found or if none helped, then a strong cylinder was placed at whatever axis objective tests might have suggested and from this position rotated to various meridians till one was found where improvement was noted. With the cylinder in the frame at this meridian, another strong cylinder of the same kind was held before it in the same axis and if this offered promise of improvement, further additions were made by setting one, two, or three cylinders in the frame and holding others in position by hand until no further improvement was noted by increasing the cylinder of this sign. Then plus and minus spheres were tried with this maximum cylinder and when this procedure had been followed to the limit of improvement, cylinders of the opposite sign were taken at the opposite axis. This device of crossing cylinders has proved most useful as by it the higher combinations of mixed astigmatism are reached.

In one case, for example, some improvement was noted by +8.0 D. cylinder at axis 165°, still further by a second +8.0 D. cylinder at the same axis. Further plus did not help and addition of a minus sphere helped only a little. A —8.0 D. cylinder was now tried at axis 75° with marked improvement which was increased by a second —8.0 D. cylinder at the same axis. There was now —16.0 D. cyl. axis 75° and +16.0 D. cyl. axis 165°, or a total of —32.0 D. cyl. ⊂⊃ +16.0 D.sph. Further cylinders and spheres were added and minute changes of axes tried till the best vision was obtained. With —35.00 D. cyl. axis 75° ⊂⊃ + 14.00 D.sph., V. = 14/200. Where such improvement as, for example, from 10/300 to 15/50 can be obtained in the better eye, the patient will wear even as powerful a lens as this with satisfaction.

The following cases are presented:

Case I. Miss W. L., aged 27 years when seen Nov. 6, 1915, had marked

keratoconus with vision, R. E., 15/75; L. E., 4/300 with her —5.0 D.sph. lenses. The condition progressed and numerous changes of glasses were given. In July, 1920, R., —1.50 D.sph. ⌯ +7.0 D. cyl. axis 90°; L., —4.00 D.sph. ⌯ —6.0 D. cyl. axis 130°— gave vision of 15/120 and 15/75.

May 1, 1930, the right cornea was more conical than the left. The visual test showed O.D., —14.0 D.sph. ⌯ —8.0 D. cyl. axis 105°; V. = 15/75; O.S., +6.0 D.sph. ⌯ —19.0 D. cyl. axis 90°; V. = 15/30.

These lenses were ordered but gave double vision, so a plano was placed on the right and the patient has used the left in her work as secretary up to time of her last visit in July, 1932, when the vision was 15/40— in this eye.

Case 2. Miss E. C., aged 21 years, Oct. 1, 1922, had advanced keratoconus in both eyes. O.D., V. = 2/200; with —27.00 D.sph. ⌯ —3.0 D. cyl. axis 90°, V. = 15/50; O.S., V. = 3/200; with —30.00 D.sph., V. = 15/300.

Plastic operation for keratoconus on the left eye was followed by a rather stormy recovery. The patient was seen again July 9, 1925, with O.D., V. = 15/200; with —20.0 D.sph. ⌯ —8.0 D. cyl. axis 15°, V. =15/30; O.S., V. = 15/300; with —23.0 D. cyl. axis 165°, V. = 15/75. These lenses were prescribed.

Case 3. Mr. J. H. L., aged 24 years, was seen Nov. 14, 1924. He had had poor vision since the age of 17 years, but it had become much worse recently. Examination revealed practically clear conical corneas with vision of 5/300 in each eye.

Distal lenses —34.0 D.sph. gave vision of 15/20 and with +4.0 D.sph. added to the object side the patient could read J. 1.25.

On reexamination a few days later with trial case lenses, subjective test was: O.D., —20.00 D.sph. ⌯ —20.00 D. cyl. axis 180°, V. = 15/30; O.S., same.

These glasses were prescribed and worn until the last visit of the patient one year later when vision was reduced to 15/50 with the same lens, and could not be improved. He stated that his lenses had been a great satisfaction to him and a matter of interest to many oculists whom he had visited as a traveling salesman.

Case 4. Mr. I. F., aged 34 years, in November, 1924, had advanced keratoconus which had grown much worse in the past two years. There was an opacity below the center of the right cornea.

The left conus was not so advanced. O.D., V. = 4/300; with +14.00 D. cyl. axis 165° ⌯ —21.00 D. cyl. axis 75°, V. = 14/300; O.S., V. = 14/200; with +2.00 D.sph. ⌯ —10.00 D. cyl. axis 125°, V. = 14/40.

With his —7.0 D. cyl. axis 120°, left vision = 14/70. A plastic operation was performed on the right cornea, Nov. 1, 1924.

In September, 1925, O.D., V. = 14/200; with +4.0 D.sph. ⌯ —2.0 D. cyl. axis 165°, V. = 15/75; O.S., V. = 5/300; with +6.0 D. cyl. axis 37° ⌯ —16.00 D. cyl. axis 126°, V. = 15/30—.

These lenses were ordered and worn for some time, but in March, 1926, O.D, V. = 15/100; with +3.0 D.sph. ⌯ —16.0 D. cyl. axis 20°, V. = 15/50; O.S., V. = 15/100, with his lens. No change was made as he was trying a contact glass until October 1927, when subjective tests gave O.D., +7.0 D.sph. ⌯ —22.0 D. cyl. axis 20°, V. = 15/75; O.S., +3.0 D.sph. ⌯ —16.0 D. cyl. axis 155°, V. = 15/75.

These lenses were ordered and worn until the patient was seen on Nov. 4, 1930. Vision of the right eye and refraction remained the same; vision of the left had been reduced to hand motion by attacks of iritis.

Case 5. Mrs. W. J. F., aged 61 years, was seen Aug. 25, 1932, having a detached retina in the right eye. In the left was a well-developed keratoconus of long standing. O.D., V. = fingers at two feet; O.S., V. = 2/300; with —12.00 D.sph. ⌯ —30.00 D. cyl. axis 160°, V. = 15/100. A lens was ordered for the left eye.

On Oct. 22, 1932, she was much pleased with her lens with which vision was 15/75—.

None of these patients with conical cornea has had good vision with any

lens and in all cases observed for any number of years the condition became steadily worse. Nevertheless the vision was so much better with the high cylinders than without that they were able to carry on; wore the somewhat ungainly spectacles, and were grateful for them.

Several cataract patients have developed rather high astigmatism after operation. Two cases are presented from a number in which strong cylinders gave useful vision.

Case 6. Mr. E. C. B. Available record dates back to November 1898 when the patient was 21 years of age and had myopia of nine diopters, which increased very little up to 1916, when uveitis reduced vision in the right eye to 15/50 and resulted in detachment of the retina in the left. Lens opacities first appeared in the right eye in 1920. Extraction, right, was made in June, 1926, using the combined method, with capsulotomy. There was good recovery. Vision August, 1926, in the right eye with —2.75 D.sph. ⌯ +9.75 D. cyl. axis 175° = 15/16. This lens was prescribed. In August, 1927, the best vision was 15/16—, with —4.5 D.sph. ⌯ +11.00 D. cyl. axis 165°. This change was made and the glass worn with comfort as bifocal with +4.0 D.sph. added with which he could read D. 0.5 type with little difficulty.

In January, 1932, vision with above was 15/30; with —6.5 D.sph. ⌯ +13.0 D. cyl. axis 165°, V. = 15/16—. This correction with +4.0 D.sph. reading segment is now being worn.

Case 7. Mrs. D. B., aged 56 years, had intracapsular cataract extraction, left eye, in September, 1923. Slightly delayed healing was the only complication but three weeks after the operation the ophthalmometer showed a high degree of astigmatism, axis horizontal.

Vision O.D., was 4/300; O.S., +7.00 D.sph. ⌯ +11.00 D. cyl. axis 165°, V. = 15/50+.

A temporary spherical lens was prescribed and worn till December, 1923, when with +3.0 D.sph. ⌯ +17.00 D. cyl. axis 15°, V. = 15/30—.

This lens was ordered as a bifocal with +4.0 D.sph. added and worn with satisfaction till November, 1924, when an operation was performed on the right eye.

In January, 1925, the visual test was: O.D., +10.00 D.sph. ⌯ +2.00 D. cyl. axis 125°, V. = 15/12—; O.S., +3.50 D.sph. ⌯ +15.00 D.cyl. axis 15°, V. = 15/16—. With +3.5 D.sph. added, she read D. 0.50 readily with each eye.

January, 1926, the patient returned for a re-test, with the following result: O.D., +10.00 D.sph. ⌯ +2.0 D. cyl. axis 125°, V. =15/16—; O.S., + 3.50 D.sph. ⌯ +13.0 D. cyl., axis 15°, V. = 15/20.

In 1927 the vision of the right eye was seriously impaired by retinal hemorrhages so that her vision was: O.D., = hand motion; O.S., = 15/12— with her glass.

Seen in 1929 the vision was: O.D., +10.00 D.sph. ⌯ +2.0 D. cyl. axis 125°, V. = 10/200; O.S., + 3.50 D.sph. ⌯ +15.0 D. cyl. axis 15°, V. = 15/12—.

In 1931 it was essentially the same. In this case the high degree of astigmatism found in the postoperative period has remained only moderately diminished for eight years, during which time she has enjoyed practically normal sight with this rather unusual correction.

Conclusions

1. In some cases with very high degrees of irregular astigmatism better vision can be given by cylindrical lenses of unusual strength.

2. The fitting of such lenses requires persistent cooperation between patient and examiner in prolonged subjective tests, aided by the use of any objective device that may give a clue to the nature and degree of error and direction of axis.

3. No definite limit can be set to the strength of lens that may be worn with satisfaction so long as vision is improved by it.

4. Very high astigmatism is rare after cataract operations; when it does occur proper corrective lenses may still be fitted which will give satisfactory vision unless some other cause exists for defective sight.

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CONTRIBUTION TO THE PROBLEM OF ENZYME-ACTION IN THE MECHANISM OF CATARACT

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The pH of normal cattle lenses and of human cataractous lenses was determined. The acidity of the latter was found to be favorable to autolysis of lens protein. That this had occurred was proved by the presence of free tyrosin and tryptophan, substances not present in normal cattle lenses. Lipoids do not affect the rate of autolysis, but change the isoelectric point of the lens protein. The pronounced yellow or brown color of cataractous lenses is not due to enzymatic melanin formation, but more probably to the oxidation of free tryptophan. This research was conducted in the Department of Ophthalmology, College of Physicians and Surgeons, Columbia University.

The protein of the crystalline lens consists of a water-insoluble fraction and a water-soluble fraction which may be separated by fractional precipitation into three individual proteins. If the hydrogen-ion concentration is brought to a pH of 5.00 the alpha crystallin separates out. The beta crystallin precipitates at pH 5.8. A small third fraction remains in solution, the gamma crystalline, and does not precipitate by change of reaction of the solution[1].

When cataract develops the normally transparent lens becomes cloudy. The soluble fraction of the protein gradually disappears. The sutures widen and are filled with a fluid medium. Lamellar separation of the lens fibers and vacuole formation within the fibers take place. As the cataract progresses the lens loses in weight. The sodium-nitroprussiate reaction for glutathion becomes negative while the color of the lens changes from yellow to reddish brown and dark brown. In other forms of cataract the color is an opaque white with the appearance of a softened mass of coagulated dirty egg-albumin. According to Burge[2] the Ca of the lens increases while the K decreases. Mashimo, Kronfeld, and Schmerl and Thiel[3] studied the respiration of the lens and found a marked decrease of the respiratory quotient in cataract, while the ether-soluble substance increased materially.

Opinions as to the etiology of cataract are as numerous as the conditions under which cataract may develop. One of these theories considers the autolytic action of enzymes to be the responsible factor.

Many different causes may give rise to a condition which will promote destructive activity on the part of the enzymes, either by inhibiting the protective action of certain enzymes or by activating proteolytic enzymes.

The permeability and elasticity of aged tissues is decreased. There is a general slowing up of all processes of oxidation (inner respiration). This may bring about degenerative changes in the cells. With the disintegration of the cell, intracellular proteolytic enzymes may be set free and cause autolysis of other cellular protein.

One of the most important factors for enzyme activity is the reaction of the medium, the hydrogen-ion concentration or pH[4]. In living tissue the pH is held within narrow limits. For the lens the pH lies at an average of 7.38[5].

Acknowledgments are made to Professor John M. Wheeler, Dr. Louis Bauman and Dr. Daniel B. Kirby.

The physiological variations do not exceed plus or minus 0.1 unit. Greater variations may be considered pathologic and may cause damage to the cell or cellular constituents.

Abnormal variations in electrolytic concentrations, especially Ca and K, also affect enzyme activity[6]. Calcium and potassium are mutually antagonistic in their effects on permeability and irritability of a cell. They may also affect enzyme activity, either by influencing the state of aggregation of colloidally dissolved substances, or by removal or activation of co-enzymes.

Clapp, Hoffmann, and Goldschmidt were amongst the first investigators who favored the theory of abnormal enzyme activity as the cause of cataract formation[7]. The activity of proteolytic enzymes present in the cell may be initiated by protoplasmic changes within the cell[8]. The death of a cell usually results in increased acidity and local acid areas thus created will promote autolysis. During autolytic activity the protein molecule is broken down through various stages to its constituent amino acids. With the exception of tyrosin and tryptophan, the amino acids are quite soluble and remain in solution. Tyrosin crystals have been reported present in cataractous lenses[9].

The lens also contains oxidizing enzymes and lipases. Catalase, oxygenase and peroxidase have been demonstrated in the lens and ocular fluids[10]. Oxygenase and peroxidase are catalysts for oxidative processes within the cell (inner respiration). Catalase, by breaking down peroxides within the formation of active oxygen, retards cellular oxidation[11].

Enzyme activity as a factor in cataract formation forms the basis of the work herein presented. In pursuance of this work the following problems were investigated:

1. The pH of normal cattle lenses and of cataractous human lenses.
2. Cause of observed color changes in cataractous human lenses. Investigation as to the presence of insoluble amino acids; a. Tyrosin, b. Tryptophan.
3. Determination of hydrogen-ion concentration for the optimum activity of proteolytic enzymes of the lens.
4. The effect of ether-soluble substances on the activity of the proteolytic enzymes of the lens.

The cattle lenses were obtained from a New York slaughter house, not later than eight hours after the death of the animals. The lenses were decapsulated, washed in sterile water and dried in vacuum over $CaCl_2$. The lenses used for pH determination were decapsulated immediately after the death of the animals and kept under oil, to prevent loss of CO_2. Toluol and chloroform were used as antiseptics.

1. The pH of normal cattle lenses and of cataractous human lenses

The pH was measured with the nitrophenol indicators recommended by L. Michaelis[12]. The lenses were introduced into Thunberg's test tubes, containing 45 c.c. of freshly distilled water and indicator. The tubes were then filled with oil replacing all air, stoppered, and shaken in a shaking machine for one hour. A clear solution resulted with only a small amount of insoluble albuminoid at the bottom of the tubes.

Table 1 gives the results of the pH determination of fifty cattle lenses.

Table 1

pH OF NORMAL CATTLE LENSES

40 lenses	pH 7.4
7 lenses	pH 7.5
3 lenses	pH 7.6
average	pH 7.4

Cataractous human lenses were treated in the same manner, precautions being taken to prevent the escape of CO_2 by their immersion into paraffin oil immediately after their removal from the eye in the operating room.

The pH obtained in these lenses is shown in table 2.

Table 2

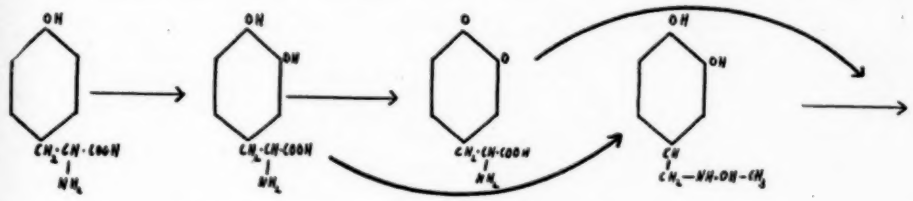
pH OF CATARACTOUS HUMAN LENSES

4 lenses	pH 5.8
4 lenses	pH 6.2
4 lenses	pH 6.4
4 lenses	pH 6.5
1 lens	pH 5.9
2 lenses	pH 6.0
2 lenses	pH 6.3
3 lenses	pH 6.6
1 lens	pH 6.1
average	pH 6.2

2. Cause of observed color changes in cataractous human lenses

The amino acids tyrosin and tryptophan are difficultly soluble in water. Tyrosin is easily oxidized by the enzyme tyrosinase. This enzyme also acts upon p-cresol and dioxyphenylalanin. While the former is not present in the lens, the latter may appear transitorily. The mechanism of oxidation of adrenalin and o-chinon to melanin, whose structural formula is unknown, has not been ascertained. Chemically it seems probable that a condensation leads to heterocyclic rings, and substances like indol, scatol, and pyrrol may take part. Electrolytes are necessary to stimulate the reaction and the face covered with toluol, and it was left standing at room temperature for two days (22° to 25° C.). After this period the fluid was centrifugalized and the supernatant fluid dialized for one week. The solution was concentrated under a current of air to 1/10 of the original volume, and glycerine added to make it a 75 percent solution of glycerol. This stock solution was kept in the ice box in a dark bottle.

Normal cattle lenses were cut with a sharp knife into small discs which were introduced into small Erlenmeyer flasks. Buffer solutions were added to insure the following pH values: 5.8, 6.2, 6.8, 7.2, 7.6, and 8.0. A current of air was bubbled through the solutions



Tyrosin Dioxyphenylalanin o-Chinon Adrenalin Melanin

anion phosphate and the cations Ca, Zn, and Cd, of which Ca alone has been found in the lens, play an important rôle. By buffering the test solutions with phosphate salts enough is added to activate the enzyme tyrosinase. The phosphate buffers were prepared according to Soerensen[13].

Testing for tyrosin. No specific test for tyrosin is known that will detect its presence in a free state in a protein solution, aside from the effect of tyrosinase[14]. Therefore to test for free tyrosin in either the normal cattle lens or in human cataractous lenses tyrosinase was added. In the presence of oxygen and tyrosin a red color develops at pH 5.8 to 6.0. The solution becomes colorless at pH 6.8. If the reaction is alkaline (appr. pH 8.0) dark melanin is formed

The tyrosinase was prepared in the following manner: Potatoes were crushed, the resulting fluid was first filtered through a piece of gauze and the filtrate allowed to stand for thirty minutes. The supernatant fluid was poured off from the sediment, its surface covered with toluol, and it was left standing at room temperature for two days (22° to 25° C.). After this period the fluid was centrifugalized and the supernatant fluid dialized for one week. The solution was concentrated under a current of air to 1/10 of the original volume, and glycerine added to make it a 75 percent solution of glycerol. This stock solution was kept in the ice box in a dark bottle.

Normal cattle lenses were cut with a sharp knife into small discs which were introduced into small Erlenmeyer flasks. Buffer solutions were added to insure the following pH values: 5.8, 6.2, 6.8, 7.2, 7.6, and 8.0. A current of air was bubbled through the solutions to provide oxygen. No color change occurred for twenty-four hours. After twenty-four hours a dark color appeared at the periphery of the sections buffered at pH values of 5.8, 6.2, 7.6, and 8.0 while the sections buffered at pH 6.8 and 7.2 remained clear. Forty lenses were tested in this manner.

No free tyrosin was present at the beginning of this experiment. Free tyrosin appeared only after twenty-four hours, due to the breaking down of the protein molecule during the course of experimentation.

Human cataractous lenses also were tested for free tyrosin. They were collected in the operating room of Presbyterian Hospital. Lenses were also received from the New York Eye and Ear Infirmary whose cooperation is gratefully acknowledged. The desiccated lenses were ground up with a small amount of glycerol. The glycerol extract was then diluted with an equal amount of water. The final volume of 10 c.c. contained material from 30 human lenses in 50 percent glycerine.

This glycerol extract was divided in-

to ten equal parts of 1 c.c. each, quartz test tubes being used. The tubes were buffered at different pH values, as were the normal beef lenses, and treated in the same fashion. After two hours the tubes showed a marked change in color. The tubes buffered at pH 5.8 and 6.2 assumed a pinkish color which slowly changed to red. The tubes buffered at pH 8.0 turned a grayish dark color and contained, after 24 hours, a dark precipitation.

This test was repeated under identical conditions with a solution of normal cattle lenses. No change of color occurred.

Free tyrosin is present in human cataractous lenses.

Tyrosinase. Normal cattle lenses and cataractous human lenses were tested for the presence of tyrosinase.

ized and the powder (12 gr.) was emulsified in glycerol in the manner described. The extract was then treated with tyrosin buffered at different pH values. While control tests with meal worm were positive after less than thirty minutes, the lens material did not react after thirty days.

The same test was now repeated substituting p-cresol for tyrosin. Control tests with meal worm were also set up. The result was negative after thirty days while the control tests were positive after a few minutes.

The presence of tyrosinase could not be demonstrated in cataractous human lenses.

Altogether 100 fresh and 100 autolized cattle lenses were used in these tests, furthermore 30 gr. of desiccated powdered human cataractous lenses.

Table 3

BROMINE TEST FOR TRYPTOPHAN IN HUMAN CATARACTOUS LENSES

Color of lens:	positive	negative	doubtful
gray	4	—	—
yellow	4	5	1
reddish-brown	5	1	1
light-brown	3	—	—
dark brown	—	—	1
	16 = 64%	6 = 24%	3 = 12%

Normal cattle lenses. Fourteen lenses were cut into sections and exposed to a 0.1 percent solution of tyrosin buffered at different pH values. After five days there was no trace of change in color in any of the tubes.

This finding being negative it was repeated with p-cresol in 4.0 percent solution and 0.9 per cent of alanin. (Tyrosinase acts on this mixture and there develops a range of beautiful colors varying from yellow to deep violet[15].) Fourteen lenses were used in this experiment. The solutions remained unchanged for thirty days.

As a control, sliced pieces of the meal worm (tenebrio molitor), which is known to contain tyrosinase, were used. The reaction was positive.

No tyrosinase is present in normal cattle lenses.

Human cataractous lenses. Desiccated human cataractous lenses were pulver-

The absence of tyrosinase from normal cattle lenses and human cataractous lenses was further confirmed by the dopa-reaction. This reagent, dioxyphenylalanin is extremely sensitive and is converted into a dark melanin by the slightest trace of the enzyme. Slices of normal beef lenses and glycerol-extracts from normal beef lenses failed to give a positive reaction, nor could a positive reaction be obtained if the lens was buffered in a medium prepared from the aqueous humor, which had been removed with a hypodermic syringe from cattle eyes. The same negative result was obtained if cataractous lenses were used, powdered or sliced on a freezing microtome. Control cuts from meal worm, treated in the same manner gave positive results.

Tyrosinase, therefore, is not present, even in traces, in either normal cattle

lenses or human cataractous lenses, and the color of the cataractous lens can not be explained by the action of tyrosinase on the free tyrosin found present in the cataractous lens.

Tryptophan. The presence of free tryptophan in the lens was tested for with bromine water. Bromine water added to tryptophan gives a reddish-violet color. A slight excess of bromine will interfere with the reaction. Isolation of the tryptophan by dialysis is not feasible, as its concentration is too minute and prolonged dialysis might result in hydrolysis of the lens protein, freeing some of its constituent amino acids.

The color reaction of tryptophan with bromine water is said to be specific[16]. The test was performed speedily, in order to avoid a breakdown of the protein material by bromine action. In cataractous human lenses the normal color makes it sometimes difficult to see the violet shade while in other lenses the color is only transitory. For comparison tests tryptophan prepared from casein was used.

Normal cattle lenses. Series of 20 normal cattle lenses failed to give a reaction. No free tryptophan was found to be present in these lenses.

Cataractous human lenses. Twenty-five lenses were tested (table 3) of which 65 percent gave a positive reaction, 24 percent a negative reaction, and 11 percent a doubtful reaction.

Twenty grams of pulverized human cataractous lenses were ground in a mortar with 10 c.c. of water, and bromine water was added to the emulsion until a pinkish color appeared. This mixture was then extracted according to the method of Neuberg[17]. It was washed into a separatory funnel with dilute acetic acid and extracted with ethyl-acetate. The brominated tryptophan dissolves in the ethyl-acetate with red color. Comparison was made with a standard solution of tryptophan in a Dubosque colorimeter. The amount of tryptophan extracted from twenty grams of lens material did not exceed 1.2 mg.

Free tryptophan is present in cataractous human lenses.

Table 4

THE RATE OF AUTOLYSIS OF LENS PROTEIN MEASURED BY THE INCREASE IN FREE AMINO-NITROGEN.

pH of solution	7.9		7.1		6.8		6.4		6.0		5.6	
amino-acid nitrogen, mg. in 10 c.c. sol.	Kjeldahl Method	Formol-Titrat.	Kjeldahl Method	Formol-Titrat.	Kjeldahl Method	Formol-Titrat.	Kjeldahl Method	Formol-Titrat.	Kjeldahl Method	Formol-Titrat.	Kjeldahl Method	Formol-Titrat.
in fresh sol.	1.16	1.18	1.16	1.18	1.16	1.18	1.16	1.18	1.16	1.18	2.00	1.96
after one day	1.16	1.18	1.18	1.18	1.20	1.22	1.20	1.18	1.45	1.47	2.40	2.42
after two days	1.16	1.18	1.20	1.22	1.40	1.47	1.60	1.64	2.00	2.04	2.70	2.66
after three days	1.16	1.18	1.22	1.23	1.60	1.61	1.98	2.00	2.64	2.63	2.97	2.94
after four days	1.16	1.18	1.26	1.26	1.80	1.89	2.30	2.24	3.30	3.22	3.28	3.33
after five days	1.16	1.18	1.28	1.28	1.98	1.97	2.65	2.69	3.88	3.85	3.52	3.50
after six days	1.16	1.18	1.30	1.32	2.20	2.28	3.00	3.08	4.40	4.45	3.77	3.85
after seven days	1.16	1.18	1.32	1.33	2.40	2.38	3.38	3.39	5.00	4.97	4.10	4.13
after eight days	1.16	1.18	1.34	1.36	2.60	2.63	3.70	3.75	6.04	6.02	4.40	4.40
after nine days	1.16	1.18	1.36	1.36	2.70	2.73	4.00	4.06	6.60	6.58	4.70	4.60
after ten days	1.16	1.18	1.38	1.39	3.00	2.94	4.40	4.41	6.80	6.89	4.95	4.97
after eleven days	1.16	1.18	1.39	1.42	3.20	3.25	4.80	4.76	7.28	7.28	5.33	5.32
after twelve days	1.16	1.18	1.40	1.47	3.40	3.29	5.18	5.25	8.08	8.19	5.59	6.02

3. Determination of pH for the optimum activity of proteolytic enzymes

In human cataractous lenses a change in reaction from the alkaline side to the acid side has been demonstrated. The pH of such lenses lies close to the isoelectric point of beta crystallin (pH 6.0).

In order to study this problem more closely lens-protein solutions, containing 50 mg. of total nitrogen per 10 c.c. of solution, were buffered at pH values of 7.9, 7.1, 6.8, 6.4, and 6.0. The protein that precipitated out at pH 6.0 was filtered off and the fractions that remained in solution were buffered at pH 5.6. These last two solutions, therefore, contained no beta crystallin. The solutions were then allowed to autolyze in the incubator at 37°C. In order to determine the degree of autolytic activity the amino-acid nitrogen was determined every 24 hours by formol titration as well as by the Kjeldahl method[17] (table 4). The nitrogen thus determined includes the nitrogen which was not precipitated by a 5-percent solution of sulfosalicylic acid.

No urea, uric acid or creatinine has been found in the crystalline lens[18]. O'Brien and Salit[19] report the presence of 20.8 mg. urea in 100 gr. of lens material. The close check obtained between formol titration and Kjeldahl method proved that the amino-acid nitrogen of unautolyzed as well as autolyzed lens protein consists of amino-acid nitrogen. Ammonia was found in traces only.

No autolytic change was found in the protein solution buffered at pH 7.9. The original concentration of amino-acid nitrogen of 1.16 mg. per 50-mg. total nitrogen did not change.

A slight but steady change occurred in the solutions buffered at pH 7.1. With decreasing pH (6.8) there was increasing hydrolysis of protein and this reached its optimum at pH 6.0. Beyond this point if the solution was still further acidified the activity of the autolytic enzyme decreased again.

The optimum proteolytic activity lies at pH 6.0 (fig. 1).

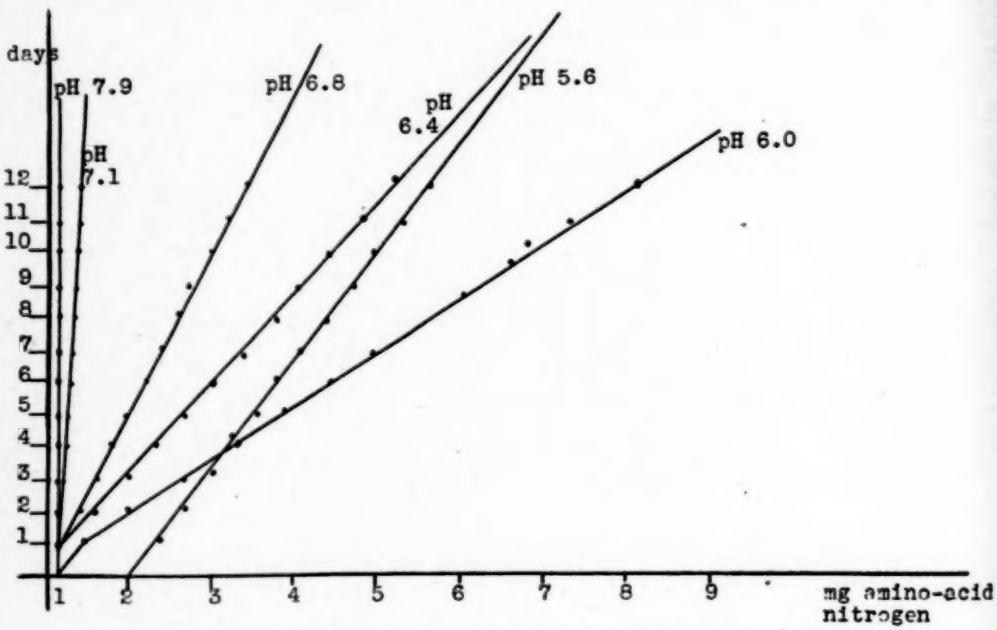


Fig. 1 (Sauermann). Rate of protein decomposition at different pH values.

The single fractions of the lens protein. In order to determine whether enzymes influence one fraction of lens protein more than the other solutions, single

fractions were prepared. The solutions containing the single fractions were dialyzed and cleared by Berkefeld filtration. They were buffered at different pH values and the autolysis was studied. The results obtained did not vary from those obtained on the three fractions in one solution. There was no change at pH 7.9 and a slight change at pH 7.1 from whence the deterioration of the lens protein increased until pH 6.0 was reached. If there was more acid than pH 6.0 the reaction became slower again.

4. The effect of ether-soluble substances on the activity of the proteolytic enzymes of the lens

In human cataractous lenses the appearance of ether-soluble substances becomes conspicuous. This change may be primary, in which case it may inaugurate the activity of the lens-enzymes, or the appearance of the lipoids may be secondary to autolysis.

In order to determine the effect of the ether-soluble substances on the autolytic breakdown of the lens-protein, lipoid-free protein was prepared by treating it in a Soxhlet apparatus with petrol-ether, until a sample of the petrol-ether was free from residue after evaporation. These extractions lasted from five days to one week. It did not result in a breakdown of the protein molecule and the lipoid-free protein gave typical protein reactions. Fractionation and isolation of the single crystallin-fractions by means of acidification could be carried out. No denaturation of the lens protein resulted from the treatment of the lens protein with petrol-ether at 40°C. The lipoid-free protein was dried in the air. After disappearance of the last trace of petrol-ether solutions were prepared and buffered at pH values of 7.9, 7.1, 6.8, 6.4, 6.0, and 5.6.

The results did not vary from those attained in previous experimentation. There was inactivity at pH 7.9, slight activity at pH 7.1 which increased until pH 6.0 was reached. If there was more acid than pH 6.0 the activity of the enzymes decreased again.

To a series of solutions which had been buffered in the foregoing manner lecithin was added in geometrical progression, starting with 0.5 percent lecithin. The lecithin had been purified according to the MacLean method[20] and contained 3.5 percent phosphorus.

The results of the autolysis agreed with those obtained before. The only difference found was that the solutions buffered at pH 7.1 and containing 2.0 percent of lecithin suffered a delay of about one week until the amino-acid nitrogen increased. The autolysis then progressed as had been the case with solutions free from added lecithin.

Solutions of lens protein left unbuffered autolyzed and the pH gradually changed until pH 6.0 was reached. After that the solution was left in the incubator for six weeks but no further change in acidity took place.

If to the same stock solution lecithin is added in no greater amount than 0.5 percent the maximum of pH 6.0 is also reached without further change. Solutions containing a greater concentration of lecithin changed to more acid solutions. Those containing 4.0 percent of lecithin reached a pH of 5.6. At this point no precipitation of the beta crystallin had occurred, as would have been the case if no lecithin had been added. Only a slight turbidity became more conspicuous. If the solution became still more acid precipitation of the beta crystallin occurred at pH 5.5 to 5.3.

While the amount of lecithin has no influence upon the autolytic process, the precipitation of beta crystallin takes place at more acid reaction than the normal isoelectric point. Solutions of lens protein containing an excess of lecithin become more acid on standing than they would without the addition of lecithin. This finding is in agreement with the pH of cataractous lenses which may be more acid than pH 6.0.

Conclusions

Though there is positive evidence that free tyrosin is present in cataractous lenses there was no evidence of an enzyme that might convert tyrosin into some other chemical combination. This finding of free tyrosin and the

positive identification of tryptophan gives evidence that cleavage of the protein molecule has taken place.

In cataract the crystallins disappear and the lens loses in weight. Insoluble albuminoid remains and forms the remnant of the lens. The soluble hydrolytic products are gradually removed or stay in solution and only the more or less insoluble amino acids, tyrosin and tryptophan are precipitated. While tyrosin is comparatively stable this is not the case with tryptophan. Tryptophan is known to be very unstable, even without the interference of enzymes. Chemically it is closely related to many colored and non-staining substances, such as indigo, indol, scatol, indigotin and indirubin. The complete failure to find evidence of the oxidation of tyrosin into melanin makes us believe, that tryptophan rather than tyrosin may be the causal agent of the coloring of the lens in cataract.

Autolysis of the lens protein does not take place if the solution is buffered at a pH more alkaline than 7.1. Slight autolysis takes place at pH 7.1. It increases with the acidity and reaches the greatest rate at pH 6.0. If such a solution is made more acid than pH 6.0 the speed of autolysis decreases again.

The addition of lecithin does not influence the autolytic activity, except that it causes a delay in weak alkaline solutions.

The removal of the lecithin that is normally present in the protein has no influence upon autolysis.

The addition of lecithin causes a shift in the maximum acidity that develops in lens-protein solutions on standing. This has its corollary in the observed decrease in the pH of cataractous lenses that also show increase in the ether-soluble fraction.

Summary

The pH of normal cattle lenses and of human cataractous lenses was determined, averaging 7.4 and 6.2, respectively.

There is no free tyrosin in normal cattle lenses but free tyrosin is present in cataractous human lenses.

There is no tyrosinase, either in normal cattle lenses or in human cataractous lenses.

There is no free tryptophan in normal cattle lenses, but there is free tryptophan in cataractous human lenses.

The autolysis of lens protein was studied in pure lens-protein solutions and in lens-protein solutions together with lecithin. It has been shown that no autolysis occurs if the reaction is alkaline (pH 7.9). Slight autolysis occurs at almost neutral reaction and autolysis increases with increasing acid reaction until pH 6.0 is reached.

The presence of lecithin does not influence either the rate or degree of autolysis. The presence of lecithin causes a shift in the end point of the gradually developing acid reaction to the acid side of pH 6.0. In the presence of lecithin in greater concentrations than 0.5 percent the flocculation of beta crystallin at its isoelectric point of pH 6.0 is prevented. The single protein fractions do not differ in rate or degree from those of the combined fractions.

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NOTES, CASES, INSTRUMENTS

FROST BITE OF THE CORNEA

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In March 1932, patient R. B., came to me with the following history. Four days previous he was shoveling on the highway all day with a strong wind on the right side. In the evening when he went into the house where it was warm, he noticed that the ocular conjunctiva was quite red and the lids markedly swollen. There was a slight burning sensation, equal in both eyes. The face had first degree frost bite across the cheeks and nose, and extending from ear to ear. As this caused

Fig. 1 (Carroll). Frost bite of cornea.

him no pain particularly, he did not treat the face in any manner. The next day was warmer, and as neither face nor eyes gave him much discomfort, he worked on the road all day.

The second day following exposure to the cold and wind, the right eye began to pain appreciably, and he felt as though a bit of sand were in the eye. However, he did not pay much attention to the eye nor have treatment of any sort. The following day he went to a local physician who gave him some "drops" which made the eye feel comfortable, but toward night the right eye again began to pain. This gradually became worse and the patient was up all night, using hot and cold applications in attempts to get relief. The next morning, the fourth day from time of exposure, he came to me. The right palpebral conjunctiva was slightly congested, there was intense congestion of the ocular conjunctiva with but very little swelling. The right cornea was a trifle hazy over the entire surface. At "7 o'clock", and just at the lower edge of the pupil an area 8 mm. long and 4 mm, wide was denuded of epithelium with decided haziness about the edges, with almost a ground glass appearance. The entire cornea looked as though it might break down entirely at any time and appeared as if one could take a cotton swab and wipe away the whole cornea. The nearest I can come to describing the appearance is to say that it looked like the surface of a half rotted lettuce leaf.

There was intense pain in the eye, extending well back into the temple. There was no disturbance in the corneal sensibility. A very slight swelling of the iris was present. There was no impairment of vision other than that caused by the haziness at the area of injury to the cornea. From the above examination and history I made the diagnosis of primary frost bite of the cornea. For the examination I used a few drops of 5 percent cocaine, which immediately stopped the pain and caused the pupil to dilate slightly.

For treatment I used 2 percent atropine once a day, which readily dilated the pupil, and one-half strength suprarenalin three times a day to control the congestion. Also the eye was kept covered. Recovery was uneventful requiring about ten days. No impairment of vision remained. I am reporting this case as being unusual because in looking through the literature I have been able to find but one other report of a similar condition. This is the report of Professor Gian Luigi Colombo of the Royal University at Parma. His article deals with a somewhat similar condition in an air pilot, twenty-three years of age. He is not certain that the condition was true frost bite.

Robertson Building.

SEPARATION OF THE IRIS CORNEAL ADHESION (SECLUSIO PUPILLAE) FOR THE CURE OF CORNEAL STAPHYLOMA *

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In 1917 I first described a method of operation in complete obliteration of the anterior chamber and reported a case of complete corneal staphyloma in which it was used[1]. The same year three more cases in which this method was used were reported by me[2].

I believe it is the only method of treatment in these cases that takes into consideration the underlying pathology which is seclusio pupillae and, therefore, the only operation at the present (with the exception of iridectomy, when it can be done) which will give the operator a fair chance of a good result in such a case.

The development of complete corneal staphyloma is the result of a large corneal ulcer in which only a narrow band of cornea remains after the ulcer has run its course. The iris presents in the perforation and, as a result of the adhesion of the iris to the corneal rim, seclusio pupillae always results, combined with obliteration of the anterior chamber. As soon as the corneal opening is closed, elevation of pressure is the natural result. The soft, yielding scar bulges forward which it might even do in the early stages of development with normal intraocular pressure, resulting in a staphyloma of the cornea.

If the seclusio pupillae could be removed by iridectomy, the increased tension would be more or less lowered, but iridectomy in total staphyloma is impossible on technical grounds unless previously the anterior chamber has been at least partially restored by the relief of the seclusio pupillae. If an iridectomy could be done well down to the iris root in such a case, without previous restoration of the anterior chamber, it would only open the iris angle and canal of Schlemm the length of the iridectomy, as the remaining iris would still be pressed against the cornea.

Fuchs, speaking of the treatment of staphyloma, says iridectomy is often impossible and the usual other operations for pressure (trephining) are without effect on the tension. He also says the removal of staphyloma is an operation of doubtful value, since the conditions determining increased pressure persist despite the operation. Recurrences frequently come about, or ectasias of the sclera develop.

The operation consists in the introduction of a spatula (as in Heine's cyclodialysis operation) between the iris root and the cornea, passing it forward to the adhesion of the iris to the cornea at the anterior remains of the true cornea and freeing this attachment. When there is only a very narrow rim of true cornea remaining, the spatula may have to be introduced from two or more positions.

This freeing of the iris from the cornea reforms the anterior chamber and opens the iris angle. If there is any remaining clear cornea, an optical iridectomy can now be done by cutting down on the spatula well back in the limbus and enlarging the incision with a canaliculus knife or scissors, so that an iris hook or forceps can be introduced. Or one can wait and do an iridectomy in the usual way at some later date, after the formation of the anterior chamber and the flattening of the staphyloma.

A moderate pressure bandage following the operation has been advised, but in one clinic patient, a young colored girl who developed whooping cough the day after the operation and was transferred to another ward where the bandage was removed. A fine result was obtained in spite of the whooping cough and the absence of a bandage.

The patient herein presented is a girl seven years of age. She was first seen by me when eighteen months old, in consultation with Dr. Van Dellen. She had, at this time, large perforating corneal ulcers of both eyes, caused by virulent measles. When next seen, she was five years old. She had had her right eye removed (because of a staphyloma

* Read before the Chicago Ophthalmological Society, March 20, 1933.

of the cornea) at the University of Chicago Clinic where she had been under treatment. Removal of the other eye had also been advised. A staphyloma, protruding about one and one-half centimeters, was present at this time which made the closing of the lids very difficult. Light perception was present, tension plus three, and she also had a very large eyeball due to the long continued increased pressure; the sclera seeming as thin as paper at the time of operation.

The first operation was done in April, 1931, the spatula being introduced at only one point, above and to the temporal side. The tension was greatly lowered by this operation and, in a few months' time, the cornea became almost normal in curvature. Two months ago the operation was repeated at one point, down and to the nasal side. She now has a normal tension, a flat cornea, good light perception, and a possible chance for further improvement by optical iridectomy.

30 North Michigan Boulevard

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SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

CHICAGO OPHTHALMOLOGICAL SOCIETY

April 17, 1933

Dr. Michael Goldenburg, president

Bengtsen's operation

Dr. Thomas D. Allen presented a case of glaucoma following cataract operation; several operative procedures had been instituted to control the tension, one of them the Bengtsen's modification of the usual trephining. He did not seem particularly impressed with its success.

Congenital malformation of the orbit

Dr. Francis Crage reported the case of a 24-year-old man. He had had a previous operation on the right orbit but considerable deformity remained. The eye protruded and rested at a lower level than the left eye because of the depressed lower orbital margin which made the orbit abnormally large. The globe could be pushed up into the orbit easily; movements were free and concomitant.

Discussion. Dr. George W. Mahoney said that he had operated on this man several months ago. Before operation the orbital cavity was enormous and the eye was much lower than now. An incision was made along the lower orbital margin, and the periosteum from the floor of the orbit, as far back as possible, was elevated and carefully preserved. Then the periosteum over the right tibia was opened and two large pieces of bone were removed and planted at the bottom of the cavity, bringing the periosteum down and suturing it over the bone. This operation raised the eye nearly three-fourths of an inch, clearly shown by the x-rays and photographs. The lid came down over the eye causing a ptosis, so the lid was shortened considerably. At that time the eye could not be brought up any higher, as the optic nerve would not permit.

Dr. George F. Suker remarked that if a transplant of fascia lata was contemplated it would be better to make a cartilage transplant, or another bone transplant. Either would hold much better than a hammock of fascia lata and would give a much better support.

Hypertensive retinitis

Dr. Lebensohn presented a woman, aged 50 years, who had what was called albuminuric retinitis, but this designation was a misnomer. Hypertensive retinitis was a much better term. The blood pressure was 250/150 while the urine was negative. Vision was 20/30 in each eye. There was bilateral swelling of the discs, typical signs of hypertensive retinitis, hemorrhages, with flame-shaped and cotton-wool exudates. This type of lesion was not dependent on, though associated with, nephrosclerosis. A lumbar puncture would be done to reduce the spinal pressure which would possibly reduce the swelling of the disc.

Discussion. Dr. George F. Suker asked how swelling of the disc was associated with spinal pressure in hypertensive cases.

Dr. Lebensohn replied that the papilledema present was due to cerebral edema. The spinal fluid pressure in these cases was generally over 300 mm. when papilledema occurred in hypertensive retinitis, the prognosis for life was especially poor.

Blood culture studies in iritis

Dr. E. F. Traut read a paper on this subject which will be published in the American Journal of Ophthalmology.

Discussion. Dr. I. Pilot said the work of Rosenow, Brown and Irons, with particular reference to experimental reproduction of the disease in rabbits, added a great deal to the theory that the streptococcus was the cause of iritis. The more recent emphasis that rheumatic arthritis was mostly the result of streptoccocic infection illus-

trated again the relationship between iritis and arthritis as both being possibly on a streptococcic basis. There were a few things, however that remained unexplained, particularly with reference to streptoccocci. For example, many patients had been observed in whom a large number of streptococci could be isolated in the blood, septicemia or endocarditis cases, and yet the occurrence of iritis in such patients was extremely rare. The answer to this by Rosenow and others was that the streptococcus must have a peculiar affinity for the iris. Our more recent studies in arthritis, however, had thrown a different light, and explained Dr. Traut's findings and overcome the objections made by others. If one took the blood from a patient with iritis one would not obtain streptococci with ordinary methods. As was pointed out, it required large quantities, at least one ounce of blood, separating the serum and incubating the clot for a long time, to get the positive cultural result. This meant that the organisms were present in exceedingly small numbers. Another factor must be present, namely a superior type of inflammatory response, an increased response, to an infectious agent. He said that most people did not react to an injection of streptococci, or streptococcus vaccine, but in iritis cases small doses of streptococci found tissue that had become sensitized and a marked reaction occurred. In iritis or arthritis it was necessary to have not only a focus, and an organism, but also a tissue factor which was labelled the local allergy of the tissue. There were sometimes still other factors to be considered; for example, certain types of people with vasomotor instability, climatic factors, heredity, constitutional factors. There were cases of iritis where the lesion was localized on account of trauma.

Dr. Sanford Gifford said that in acute iritis there must be showers of bacteria at one time or another in the blood. The work of Brown, Irons and Nadler was done, not with cultures obtained from the blood stream, but from the lacrimal sac, yielding a streptococcus which might not have caused the iritis at all, but their work did call attention to the organ specificity of streptococci in iritis. Dr. Kendall had made a few blood cultures on some cases of iritis, most of which had been negative. He found in one case a streptococcus in culture. The aqueous had been cultured in a few cases of iritis and streptococcus was not found. That was not altogether surprising, as the organisms were not in the aqueous, but in the blood stream.

Dr. Harry Gradle raised the question concerning bacteremia and toxemia. To an ophthalmologist it was rather difficult to conceive how the streptococcus, a pyogenic organism, might float harmlessly in the blood stream until it lodged in a terminal capillary of the iris. The changes characteristic of pyogenic organism infection did not appear, but merely those of an inflammatory, non-pus-producing organism. So it was difficult to conceive of a bacteremia being the cause of iritis. Also, when the focus of infection was removed the disease disappeared spontaneously.

On the other hand, it was difficult to conceive of an acute iritis being purely toxic in origin. The adherents of the toxemia theory would have us believe that from such a focus as a small apical abscess there could be absorption of toxins which circulated through the system and finally reaching the iris, produced an iritis. Furthermore, the gastrointestinal tract had been left out of consideration. We were unable to prove anything as to the gastrointestinal tract absorption of toxins but we were sure that some cases were due to toxemia from this source, and the condition would clear up when this focus was removed.

Dr. Peter C. Kronfeld said that it was a well known fact that for the last eight or ten years ophthalmologists were trying to explain iritis from one cause, as Dr. Pilot pointed out, from a focus of infection. But the difficulty arose from the fact that such foci were by far more frequent than examples of iritis. Tonsillitis was probably a million times more frequent than the iritis produced by tonsillitis. Study of the foci appar-

ently did not lead us very far, and for that reason Dr. Traut's findings were of the greatest interest.

Traumatic rupture of the iris sphincter

Dr. Harry Gradle read a paper on this subject, which will be published in the Wilmer dedication number of the Archives of Ophthalmology.

Dr. Robert von der Heydt said that it was important to differentiate between a direct blow and one striking the eyeball from the side. A blow onto the limbus would often cause an iridodialysis. The indentation straightened and thus elongated the curved attachment of the iris at the root, causing it to tear at the point of impact.

Dr. Gradle had described the reaction to a blow as first a contraction of the sphincter and then a dilatation. This was contrary to Dr. von der Heydt's conception; he was under the impression that the first reaction was a physiological dilatation, as witnessed by the large size of the Vossius annular ring, the latter being a direct result of the blow, a maceration of the pupillary collar pigment ring onto the anterior lens capsule. It was found only if the pupil was medicinally dilated.

It was very interesting to study fresh areas of injury to the iris under the slit-lamp. They gave an opportunity to observe closely the metamorphosis of blood corpuscles and blood tinging of the aqueous in the case of minute hemorrhages. He agreed with Dr. Gradle that there was no treatment for tears of the iris. A tear through the sphincter would usually cause a vertically oval pupil with the greater width of the iris above.

Robert von der Heydt

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

December 20, 1932

Dr. David W. Wells, presiding

Intraocular foreign body cyst

Dr. W. Holbrook Lowell presented a male patient aged 18 years, who complained of irritation in the left eye. There had been failing vision and recurrent attacks of redness in the left eye for many years, with some improvement between attacks. He gave a history of having exploded a dynamite cap when five years of age at which time his hand was injured. The general medical examination was negative. The left eye showed marked ciliary injection with cells in the aqueous; the vitreous was cloudy and the fundus details could not be made out; the tension was normal. A grayish mass extended from the region of the ciliary body into the vitreous; the surrounding sclera was of a bluish color. A foreign body .5 mm. in size was localized by x-ray in the vitreous. The magnet test was negative as expected, since the foreign body was probably copper or brass from the percussion cap. With symptomatic treatment the eye had become quiet. There was no iridocyclitis.

Unusual case of retinitis proliferans

Dr. Hugo B. C. Riemer presented a 52-year-old man who came to the Infirmary for the first time on October 10, 1932, complaining of poor vision in the right eye, of six months' duration. The vision in the right eye was shadows, in the left eye with correction 20/30. Dr. Riemer's first impression was that of of angiomatosis retinae, although it was not an entirely typical case. There were extensive white areas in the retina; the veins were enormously enlarged and tortuous and at places ampulla enlargements and nevi were seen. Streaks in the retina appeared to be as if the retina had been detached and re-attached. There were some retinal hemorrhages. The media were clear but there was a posterior synechia at "4 o'clock." A consultant thought it was a case of retinitis proliferans rather than angiomatosis. All examinations were negative including blood Hinton test. There seemed to be new retinal blood vessels which extended into the vitreous in several places.

Angiomatosis retinae, Lindau's disease

Dr. Virgil Casten presented a 48-year-old man who was admitted to the Neurological Ward of the Massachusetts General Hospital because of head-

ache and dizziness for four months. The patient first noticed sharp, shooting pain in the occipital region which soon became associated with dizziness. The attacks gradually became more frequent and lasted longer. During the last three weeks the symptoms had been quite severe with a slight defect in walking. He had had a retinal hemorrhage in the right eye four years previously. The vision in the right eye was 15/200, in the left eye 20/15. While on the ward the patient became almost comatose and was in extremely poor condition. The right eye showed a large dilated superior nasal retinal vein which, after several loops, disappeared into a large cyst. A branch of the superior temporal artery, after two or three aneurysmal dilatations, anastomosed with the inferior nasal artery and together they disappeared into the cyst. The cyst transilluminated easily. Because of the angiomatosis retinae, a preoperative diagnosis of Lindau's disease was made. An immediate operation was performed by Dr. Hodgson. A fairly large cerebellar cyst to the right of the mid-line was found. Some of the fluid was later examined and found to have an abnormally high protein content. The patient was very much better immediately following the operation. He had had no recurrence of symptoms. The fundus condition, however, was getting progressively worse. The vitreous was becoming cloudy and exudate was appearing.

Discussion. Dr. Allen Greenwood said that Dr. Kurah had reported that he had treated such patients with radium with decided improvement.

Degeneration of the macula

Dr. Edwin B. Dunphy presented a nine-year-old boy whose poor work at school was explained by defective vision. There was a rather typical pigmentary degeneration of both maculae, otherwise the fundi were normal. The visual acuity was 20/200 in each eye. Thorough physical and neurological examinations were negative. Hinton and tuberculin tests were negative. There was no history of similar trouble in the family. The psychiatrists thought that he was of average intelligence, perhaps a little dull, but there was nothing to indicate cerebral degeneration which is sometimes seen in this type of macular pigmentary degeneration.

At the International Congress of Ophthalmology at Washington in 1921, Treacher Collins summarized retinal degeneration. He pointed out that this central pigmentary degeneration occurred in two forms; one coming on at the age of six or seven years, and often, but not always, accompanied by mental deterioration later on. The other form came on in adult life with no symptoms of mental deterioration. In both forms the vision usually deteriorated fairly rapidly to about 20/200, and then the process in the retina came to a standstill. Peripheral fields were usually normal and outside of the heaping up of the pigment in the macular region, there were no other abnormal findings in the fundus.

Melanoma of the disc and hole in the macula

Dr. Merrill King presented a 13-year-old boy who came to the hospital with poor vision in the right eye. Three years ago, during an eye examination, it was found that he could see very little with the right eye and his vision had remained the same since. The history was negative as far as could be ascertained. The Wassermann test was negative. There was an area of pigmentation at the border of the disc, extending into it. There was also a well circumscribed hole in the retina in the region of the macula. Within this area the chorio-capillaris was seen.

Cataract and diabetes

Dr. Daniel Kirby read a paper on this subject.

James J. Regan,
Recorder.

COLORADO OPHTHALMOLOGICAL SOCIETY

March 18, 1933

Dr. M. Jean Gale presiding

Iridencleisis operation for glaucoma

Drs. D. H. O'Rouke and L. L. Davis presented a 60-year-old man who was first seen on February 24, 1933, com-

plaining of poor vision of the right eye for two years and of the left eye for a short time only. The tension was 51 mm. and 48 mm. (Schiötz) in the right and left eyes respectively.

On March 1st, an iridencleisis was done on the right eye, and on March 10th, on the left eye. By March 16th the tension O.D. was 23 mm. and O.S. was 18 mm. The central scotomata had diminished in size, but the same amount of peripheral contraction was still present and the visual acuity had not improved.

The case was presented to show the nature of the bleb and the immediate lowering of tension from this operation.

Retrobulbar neuritis

Dr. Wm. C. Finnoff presented Mrs. G. L. P., a white female, aged 33 years, who had been first seen on May 16, 1932. The week previously she had accidently hit the right side of her head a very severe blow. This had been followed by a headache lasting for several hours. About four days later she had noticed that the vision of the right eye was blurred. On examination, the vision of the right eye was hand movements at one foot and of the left eye, 0.3+. Ophthalmoscopic examination of the right eye showed slightly engorged, tortuous veins with a blurred disc on the temporal side, and no evidence of detachment of the retina. The left fundus was normal. On May 17th, the right disc was elevated one diopter, and on May 20th, the swelling had increased to two diopters. The pupil did not react to direct light but reacted consensually. The Wassermann reaction was negative. Four root abscesses were found and three extractions were made. By May 26th, the vision had improved (hand movements at two feet) and the neuritis was slightly less. On June 10th, pallor of the right disc was observed. By June 21st, improvement had progressed to vision of 0.5 in the right eye with —1.00 sphere. Strychnine sulphate gr. 1/30 t.i.d. was ordered. A week later, the vision was normal with the same correction. Following extraction of another tooth, the vision again failed in the right eye, being 0.4 on July 8th. The right disc became progressively whiter and on August 2nd, at her menstrual period, the vision dropped to 0.1. Afterwards the improvement was marked. On September 21st, the vision in the right eye was 1.3-3 with —1.00 sphere. The vision of the left eye with —1.00 sphere was 1.3.

The patient was not seen again until February 7, 1933, when she came in complaining of decrease in vision of both eyes, following an emotional upset. The right disc appeared pale on the temporal side, but without blurring. The left disc was slightly red and edges somewhat blurred. By February 10th, the vision in the left eye had improved to 1.2. The vision in the right eye was unchanged, and there was a large central scotoma in the right field. Since that time the right disc had gradually become slightly more pink and there was a large central scotoma in the right field. The vision had improved to .9. The central scotoma had become extensive. The left fundus remained unchanged and the vision was 1.2.

Radiographs of the skull were negative and the sinuses were negative, clinically. No evidence or history suggesting multiple sclerosis was present.

Discussion. Dr. William H. Crisp said he wondered whether the condition was not caused by a vascular change, rather than the teeth.

Dr. George Stine said that Sadler had reported a case of this kind secondary to thyroid dysfunction, and wondered whether a basal metabolism had been taken.

Dr. G. H. Hopkins asked whether the extracted teeth were cultured.

Dr. E. R. Neeper advised x-rays of vacant places in the mouth to see whether any buried roots were present. He believed pyorrhea could be a factor.

Dr. J. M. Shields expressed the opinion that dead teeth should be removed in such cases even though no infection about roots could be demonstrated.

Dr. Maurice Marcove said he had seen such a case at Wills Hospital where the removal of teeth was attended by aggravation of the symptoms, to be followed later by complete recovery.

Tumor or chorioretinitis?

Dr. William H. Crisp showed a woman aged about 50 years, who had been before the Society in February, 1931 (American Journal of Ophthalmology, August 1931, p. 817). Extending outward from the macular area of her right eye was an area of irregular retinal elevation, five disc diameters or more in diameter in all directions. The greatest height was probably not more than seven diopters, and some parts of the area were much less elevated, the retinal vessels being clearly visible and not decidedly tortuous. The patient had come in recently after an absence of two years, the vision having fallen during that time from 5/15 to counting fingers at one or two feet in the temporal field only. There were many patches of rather diffuse pigment, and there were some finger-like prolongations of the main area from the upper temporal side. The intraocular tension was not elevated. It had not seemed entirely possible to exclude the diagnosis of tumor, and yet an atypical form of chorioretinitis seemed more probable. Dr. Crisp wished the opinion of the members regarding enucleation.

Discussion. Dr. William C. Finnoff remembered that in 1922, Dr. Feingold had reported six similar cases where there had been massive hemorrhage and exudate in the macular region. Dr. Finnoff believed the elevation was due to a subretinal exudate.

Dr. William C. Bane thought the eye should be enucleated.

Dr. George Stine mentioned that he had reported a similar case (American Journal of Ophthalmology, 1929, v. 12, p. 916) before the society several years ago from the Colorado General Hospital.

Hole in macula, bilateral

Dr. J. M. Shields presented Miss E. D., a nurse, aged 37 years. She thought her distance vision had never been quite normal. As a child she had had granulated lids and had been treated by a physician in Oklahoma. Lenses had been prescribed for her but she had never worn them. This patient being a nurse had had a careful physical examination and a negative Wassermann reaction. Under homatropin the vision was 6/8 in the right eye and 6/6 in the left eye with approximately +2.00 sphere each eye. With this she read Jaeger 1 at 14 inches. The eye showed no pathology aside from the unusual picture seen with the ophthalmoscope. The right macula showed an area, oval in shape, which simulated a hole in the macula which was shallow and showed no pigmentary change. Scattered all over the fundus this peculiar pitting was seen. The areas were more numerous temporally and above than elsewhere. The depressions were better seen in the shadow than in the bright light of the ophthalmoscope. The left eyeground showed exactly the same condition but there were three of these curious rings directly in the macular region and other areas were found in the fundus. The discs were normal and there was no pathology of the vessels. Dr. Shields believed they involved the membrane of Bruch or that they might be due to some change in the pigment epithelium of the retina, and presented the case to get opinions as to the nature of the condition. No scotomata could be found.

Discussion. Dr. William C. Finnoff referred to similar cases reported by Bedell. Dr. Finnoff said he had seen a similar case three years previously with a small indistinct central scotoma, there being white spots about the macular lesion. The patient had since shown pigmentary change. Dr. Finnoff believed these cases were degenerations.

Dr. Edward Jackson thought that such spots as here described might be due to ruptured cysts in the retina.

Spontaneous absorption of a traumatic cataract

Drs. Edna Reynolds and Maurice Marcove presented Mr. J. G., a 40-year-old laborer, who was first seen on May 28, 1932, with a complaint of blindness in the right eye of nine months' duration. While working as a stoker in a smelter from 1915 to 1918 the right side of his face had been subjected to considerable heat. The patient said that there had been no injury or inflamma-

tion and that the vision of his right eye had been good until September, 1931, when the right lower lid had been cut with a piece of steel while he was hammering some rivets. He thought no fragment of steel had penetrated the eyeball. In October, 1931, an oculist had found a cataract of sufficient density to preclude a view of the fundus.

When admitted to the clinic the vision of the right eye was hand movements at one foot; of the left eye, 1.-2. The x-ray was negative for foreign body. The left fundus was normal. The blood Wassermann reaction was four plus so he was referred for treatment. No diabetes was present. On June 25, 1932, he returned to the eye clinic with complaint of inflammation of the right eye. Examination showed the presence of an iridocyclitis which subsided in a few weeks under atropin and salicylates. On July 15th, the tension was found to be 48 mm. (Gradle-Schiötz) but was reduced to near the normal level by the use of pilocarpin. On August 29th, he was referred to the Denver General Hospital, but Dr. Marcove postponed operation because a deep anterior chamber and a disintegrated appearance indicated absorption of the cataract.

At the time of presentation the lens material was practically all absorbed. Fundus details were not visible due to haziness of the vitreous. The vision was 0.3 with a +11.00 D.sph ⊂⊃ +1.50 cyl. ax.115°. Another x-ray picture on March 11, 1933, showed absence of any foreign body.

Dr. Marcove said he had again seen the patient a week before presentation at which time the biomicroscope revealed no evidence of perforating wound in cornea or sclera, and no signs of uveitis. The lens was entirely absorbed, not even the nucleus being seen. The anterior capsule was intact, but there was a rent in the posterior capsule on the nasal side. Dr. Marcove said the case was interesting because it brought up several questions: first, what caused the cataract; second, was the nucleus absorbed or had it dropped into the vitreous; third, what caused the rupture of the posterior capsule; and lastly, was it possible that the swelling incident to the intumescence of the cataract was sufficient to rupture the posterior capsule?

Tear gas burn

Dr. G. H. Stine reported a case of tear gas burns involving the skin of the face and lids, the palpebral and bulbar conjunctiva, and the lower half of the cornea of both eyes. The injury had been caused by accidental firing of a "fountain pen" tear gas gun, the patient having been about three feet from the gun and having gotten the full blast in the face. There were first degree burns of the skin of the face with a few vesicles. The palpebral and lower bulbar conjunctiva and the lower portions of the corneas of both eyes stained intensely with fluorescein, however the effect appeared to be mostly superficial. There was marked lacrymation, and the patient complained of severe pain. The clothing of the patient was saturated with the gas, so that everyone in the treatment room noticed a severe stinging of the eyes and upper respiratory passages. The treatment consisted of the free instillation of .4 percent sodium sulphite in 25 percent of water and 75 percent glycerin, as recommended by Wurdemann in his book "Injuries of the eye." The same solution was applied to the face and skin of the lids. Butyn and atropin and bichloride ointment were also instilled in the eyes and bandages applied. Under this treatment the condition rapidly cleared up so that at the end of six days the patient was quite comfortable, and after ten days the eyes and skin of the face were practically normal.

Dr. Stine pointed out the high potency of tear gas, lacrymation being produced by a concentration as low as .0003 mgm. in one liter. Dr. Stine said that prompt neutralization of the tear gas (chloracetophenone) in the eyes as above, and of that on the skin by 50 percent sodium sulphite in alcohol prevented many days of distress.

R. W. Danielson
Secretary.

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THERMOMETRIC DIATHERMY FOR RETINAL DETACHMENT

The general attitude of ophthalmic surgeons throughout the world toward the principles and technique of Gonin's treatment for retinal detachment has been one of acceptance and appreciation. Yet the recent multiplicity of different procedures aimed at the same result is evidence of doubt whether Gonin's ignipuncture fits all cases or is immune to criticism on account of inherent defects and dangers.

Chemical cauterization and transcleral application of diathermy have each found numerous advocates (see editorial American Journal of Ophthalmology, 1932, volume 15, page 858), and the statistics of results obtained with these methods are probably quite as favorable, after allowing for variable and unreliable statistical factors, as those for Gonin's method.

In this country C. B. Walker has lately urged certain advantages from the use of multiple minute diathermic punctures around the region of the retinal detachment. He uses fine platinum needles which are left in their respective punctures until the last essential stage of the operation, which consists of a trephine opening to permit escape of the subretinal fluid. (American Medical Association meeting, 1933, Section on Ophthalmology.)

Unfortunately, as pointed out by Léon Coppez (Bulletins et Mémoires de la Société Française d'Ophtalmologie, 1932, 45th year, page 281; and Archives d'Ophtalmologie, 1931, volume 48, page 348), applications of heat by diathermy and with the electrocautery are not subject to complete control as regards exact dosage. In Gonin's method, the color of the cautery point and the length of application are the criteria employed, but these cannot be regarded as altogether adequate. As to diathermy, the strength of current used does not gauge the temperature directly applied to the ocular tissues, and we are advised to

judge when the dose is sufficient by a peculiar greenish-gray discoloration of the sclera at the point of contact—obviously not an altogether precise indicator.

Coppez suggests that the chemical cauterization of Guist and Lindner represents an attempt to standardize the effect produced, yet the amount of caustic potash applied to the trephine opening must surely be far from uniform.

In applying the high frequency current for production of heat in the ocular tissues, the lack of control is particularly manifest. The burn produced will depend upon the size of the electrode, the electrical resistance of the patient, and other factors.

Coppez tried the method of diathermic puncture with needle electrodes (the method recently modified by Walker) and gave it up because he found a tendency to development of sparks which produced necrosis of the vitreous without effectively giving rise to adhesive irritation in the choroid and retina. He argues that the only safe mode of action is to measure the temperature of the local tissues during the formation of the burn. For this purpose he has constructed what he calls a pyrometric electrode. In other words, the temperature actually developed by passage of the high frequency current through the electrode is recorded on an electric thermometer which is part of the apparatus.

By animal experimentation Coppez found that, to produce a burn which would result in an adhesive chorioretinal reaction, but without risk of scleral necrosis or of remote damage to the retina and vitreous, a temperature of eighty degrees centrigrade (176 degrees Fahrenheit) was satisfactory. With a temperature of seventy degrees centigrade practically no irritation was produced, whereas with a temperature of ninety degrees centigrade the effect was excessively destructive. It is necessary to mention, however, that Coppez starts with a cold electrode, reaches the desired temperature in from twelve to fifteen seconds, and then at once shuts off the current. Here again, it may be supposed that the result will vary somewhat according to the type of apparatus employed and the length of time required to attain the desired temperature, since the effect of the ascending temperature during the application will be cumulative, and the result will not depend solely upon the maximum temperature attained. (This point is not discussed by Coppez but seems important in consideration of his method.)

In these experiments Coppez used a circular electrode 2.5 mm. in diameter, and he obtained foci of choroiditis about 3.5 mm. in diameter and resembling the circular patches seen in disseminated choroiditis.

In spite of the mystery and elaboration associated in most minds with the use of diathermy, it may be remarked that diathermic puncture seems in fact to be merely a type of minute cautery puncture; while the nonpuncturing type of diathermic treatment for retinal detachment represents a rather complicated method for cooking the sclera to a certain temperature in order to produce adhesive inflammation in the underlying ocular coats.

For heating the sclera at an accurately measured temperature, what apparatus could be more effective than Shahan's thermophore? Relatively short applications with a small thermophore tip at a temperature of between 150 and 160 degrees Fahrenheit might be resorted to, and for encircling the detachment a small oval or slightly crescentic tip might be found advisable.

Beside the advantages of relative simplicity and of exact dosage, the thermophore would accomplish all that is accomplished by diathermy when the blunt electrode is used, and would avoid the danger of vitreous destruction which is associated with the formation of sparks from the needle electrode. It should be possible to determine by animal experimentation the most favorable temperature and the proper length of application*.

W. H. Crisp.

* After the above editorial was forwarded to the editor in chief the writer learned that a similar suggestion as to the thermophori had been made by Dr. John M. Wheeler during the recent meeting of the American Academy of Ophthalmology and Otolaryngology.

GLAUCOMA DISCUSSED AT THE OXFORD CONGRESS

Our knowledge of glaucoma has been, too much, a knowledge of its effects, based on the examinations of eyeballs removed to relieve pain, after the disease had run its course. We are beginning to learn something of the other side of glaucoma, its causes and early tendencies, and, with these, the value of early treatment. At the Oxford Ophthalmological Congress this year, as reported in the *Lancet* for July 22, the treatment of glaucoma was a chief topic of discussion, and the changes that are going on in the attitude of the profession toward the disease, were well brought up.

From Madras, with its large experience with glaucoma in its Eye Clinic, now the Government Ophthalmic Hospital, Lt.-Col. R. E. Wright pointed out that most of the cases seen there, were of the chronic, primary variety, chiefly of the noncongestive type, with high tension, advanced field changes and diminished acuity. If operation were intended, a course of preparation was undertaken to reduce the tension. Eserin was instilled, leeches applied and a purge given, and rest at night ensured. If the eye did not respond to several days of this, an adrenalin pack was applied. If tension failed to come below 25 mm. (Bailliart), Wright preferred to do an anterior sclerotomy, with a Herbert's knife, watching the effect on the iris vessels. If there was oozing the nonoperative treatment was continued, with repeated paracenteses.

He had recently been trying cyclodialysis, with results "astonishingly good." It might be a safer operation than decompression, in cases responding badly to nonoperative treatment. His experience with iridencleisis was, that to obtain good results, the patient must be kept under observation. In early, chronic or simple glaucoma, in hospital patients, who could not remain long under observation, decompression was advised.

He did not feel so sure as some surgeons, that sclerocorneal trephining was the one and only effective treatment for all cases of chronic glaucoma. He was inclined to employ iridencleisis more extensively. Yet his impression was that sclerocorneal trephining, well performed, in suitable cases, was the surest form of decompression.

Holth (of Oslo, Norway) spoke of iridectomies, before and after the use of cocain and miotics. He had now completely abandoned classical iridectomy, replacing it by iridencleisis.

Young, of Colchester, came as a strong advocate of the nonoperative treatment of glaucoma. Even with patients from a long distance, where continued supervision was impossible, the action of pilocarpin should be tested, with the aid of the tonometer. His impression was that cases which responded well, did so permanently, if strength and frequency were regulated, and if the patient was completely obedient. Much could be said for leaving well enough alone, when it was believed that conservative treatment would keep blindness at bay.

Burdon-Cooper (Bath) said no case of glaucoma should be operated on until every effort had been made to quiet the eye by some conservative treatment. Morphia soothed the nervous system causing sleep, which was a natural cure for glaucoma, and helped the miotic action of eserin.

Harrison Butler (Birmingham) said that after iridencleisis the patient might be able to leave the hospital in a week; whereas the reaction after trephining was probably the most severe of any operation on the eye. The eye was nearly always red and congested for a few days. This was exceptional after iridencleisis.

Hepburn (London) remarked that if ophthalmic surgeons could be sure nonoperative methods could produce benefit, such methods ought to be employed. His own experience led him to conclude that when the tension was high and could not be lowered by such methods, an operation was needed.

MacRae (Newcastle-on-Tyne), speaking of late infection, had operated on ninety eyes with three cases of late infection. Two of these patients recovered at once under suitable energetic treatment, and the eyes were still visually useful. The third went so long without care, that the eye was hopeless

by the time she was seen. It was useless to base statistics on the results of operations after a few weeks. In cases of trephining done years before, the proportion in which tension rose after operation was high; the number in which tension remained low for years being very small.

The Transactions of the Ophthalmological Society of the United Kingdom have a high standard of practical common sense, and the full report of this meeting will help to keep up this standard. Edward Jackson.

OCULAR RESERVES AND THRESHOLDS

The human body is marvelously adaptable to adverse stimuli, each function having considerable reserve power. Average respiration for instance is carried on with less than one-fourth the lung surface, and we are told that a person can live with one kidney removed and half the other gone. Because of extreme reserve power, it is often difficult to distinguish between health and disease, between the normal and the abnormal.

The eye also has reserve power. What is more adjustable to its function than the eye to variable light intensities? With the light adaptability of the retina, the pupillary responses, and finally the assistance of the lid, good vision is possible under variations in light intensities up in the millions of times.

Another interesting ocular reserve, more in the nature of a compensation, is the correction for chromatic aberration. It has been often stated that the eye, as an optical instrument, is very deficient. It is true that the dioptric mechanism of the human eye is chromatically aberrated to the amount of nearly two diopters between the two ends of the spectrum. This defect is compensated by the fact that the retina is relatively a monochromatic receptor, being much more sensitive to the yellow part of the spectrum. Helmholtz found, after making one eye achromatic with suitable lenses, that his visual acuity was not improved.

Recognizing nature's reserves and compensations, we must not be too ready to blame anomalies of the eyes for headaches and other ailments. For the proper interpretation of complaints and eye findings, one must first weigh the reserve power as just pointed out, and secondly, but no less important than the first, one must appreciate ocular thresholds. An ocular threshold might be defined as the borderline of first "awareness." For instance, the eye ordinarily does not distinguish between lenses less than one-eighth of a diopter apart. Therefore, to attempt refraction to a more accurate degree than this threshold would be valueless. Another example of threshold, in regard to accommodation, would be the following: in the case of a child having about fourteen diopters of accommodation and one-half diopter of hyperopia, the hyperopia represents one-twenty-eighth of the accommodative power and should cause no symptoms. But in the case of early presbyopia associated with the same amount of hyperopia, symptoms should be expected, for the threshold is far lower.

A third instance of ocular threshold, different from the above, concerns the centering of lenses. With a pair of +.50 D. spheres, if decentering was as much as 20 mm., the prismatic effect would be only one degree; consequently the importance of p.d. measurements in this cases is almost negligible. With increasingly stronger lenses this measurement assumes more and more importance and must be conscientiously considered.

The significance therefore of these two points, ocular reserves and thresholds, is simply that by means of their proper consideration one can evaluate the state of ocular health. Refraction determinations may be a science but the prescribing of glasses becomes an art.

H. Rommel Hildreth.

THE HUNDREDTH ANNIVERSARY OF AN OPTICAL COMPANY

This year is important in the annals of the optical profession of this country as it witnesses the hundredth anniversary of the founding of the American Optical Company.

Ophthalmologists keenly realize the immense progress that has been made in the knowledge of ocular anatomy,

physiology, pathology and therapeutics. They are perhaps somewhat less aware of the advances in optics, since in general they have been less interested in this branch of science. This is because they do not usually have mathematical minds and have frequently a very limited knowledge of optics and a distinct inclination to absent themselves from any discussion of this subject. At a recent meeting of the American College of Surgeons an ophthalmologist, well known for his knowledge of optics, had, by request, prepared a most interesting, simple, practical and instructive demonstration of various types of lenses. Not one single oculist entered this demonstration room though numerous ones passed the door to reach the operating rooms which were so crowded that many had to be turned away.

It is human nature to like the familiar and the well known. Optics could be so classed by few indeed. Possibly one reason is the utter inadequacy in the teaching of this subject in all but one or two of our institutions for the training of ophthalmologists. Whatever the reason, the fact exists, so it is only vaguely that they appreciate that the strides made in the perfecting of lenses and constructing instruments equal, if not surpass, the advances on the purely medical side of ophthalmology. This lack of knowledge has tended perhaps to prevent close relationship between the optical scientists and the oculists. Many of the former feel that eye physicians regard them as lacking in altruism and true scientific purpose and interested only in the commercial aspect. The thinking ophthalmologist surely should not and certainly does not, consider the scientist in optics in any such way and the sooner this is made clear the quicker will there be a close mutual understanding. When this relationship is established broadly, such difficulties as the use of trade names for lenses of different kinds and extravagant claims for these lenses could be discussed. That the public and also many of the profession are confused, if not actually deceived, by these names is certain. Patent medicines have long since ceased to adorn the office cabinets of the better doctors and the prescriptions of known ingredients have replaced the mystic. This must some day occur in the optical profession too, but the lack of wisdom in any other course will have to be shown, as well as the desire for a change in this matter by a majority of the profession.

Even if eye physicians are slow to appreciate advancement in optics, none of them could fail to realize the increased utility of modern lenses and mountings. Nothing can replace the flexibility of the normal eye but the variations in lenses and frames make it possible now to suit special needs and have added notably to the comfort and efficiency of the wearer of glasses.

The accomplishments of the optical companies in giving to the public and the profession, at a price within reason, beautiful lenses, wonderfully ground, and optical instruments of marvelous delicacy and precision is something of which they may well be proud and the Journal takes this occasion to express its congratulations to the American Optical Company for scientific development and business achievement and to wish their organization continued success.

Lawrence T. Post.

BOOK NOTICES

Histoire abrégée des vicissitudes et succès dans le traitement du décollement de la rétine. (Short history of the difficulties and accomplishments in the treatment of detachment of the retina.) By Noëlle Bercious, M.D. 157 pages. Paper covers, price 4 francs. Lausanne. Librairie Payot & Cie, 1933.

The author is associated with Gonin at the University of Lausanne. She sent out a questionnaire about the subject of this book to 150 hospital services and about 45 of these sent replies which could be used in compiling statistics of results in these cases. The book is divided into five chapters.

Chapter one: Treatment based on evacuation of subretinal fluid. Chapter two: Therapy directed against hypotony. Chapter three: Treatment to induce adhesive chorioretinitis. Chapter four: Treatment intending to remove excessive traction by the vitreous on the retina. Chapter five: Treatment based on anatomal studies of Leber amplified by Gonin.

This is an excellent summary of the methods thus far employed. The statistics are interesting but like all statistics are suggestive rather than absolute, as the enthusiasm of the reporter modifies the interpretation of his results. The operation of Gonin is discussed in considerable detail. The author believes that Gonin's work, based on the studies of Leber, has been the greatest contribution to the treatment of detachment. A somewhat incomplete index of names is appended. Several references in the text are unfortunately omitted from this list. Lawrence T. Post.

CORRESPONDENCE

Cinch-shortening operation

San Francisco, Calif.
October 3, 1933

To the Editor,
American Journal of Ophthalmology:

In Dr. Luther Peter's paper read before the Oxford Congress and recently published, several erroneous statements are made concerning my cinch shortening operation due, most likely, to a lack of extended experience with the method. In fairness to the operation I feel that those who heard or who have read the paper should be set straight.

The statements I object to are:

1. His idea of the indications for its use.
2. The constancy of excessive reactions.
3. The occurrence of adhesions between tendon and sclera.

The writer feels that his experience extending over twenty-two years and approximately two thousand operations qualifies him to make very definite statements concerning the operation and any mishaps that may occur. He has had them all, except loss of an eye or any impairment of vision, in working it up to its present position and feels that he has worked out the solutions for most of them.

1. Concerning indications for its use. Being a form of tendon shortening I can see no reason why it is not indicated in all cases where such a result is desired. Even more than other tendon shortening methods because of the certain and positive nature of its mechanics. For this same reason it can be used more safetly in phorias and in insufficiency of convergence.

2. Concerning the constancy of excessive reactions. In the absence of infection these are rare in my experience. Why others have them I do not know—never having seen anyone else do my operation. Some operators use too many shortening strands thus making a large amount of foreign substance to set up irritation. Some use subconjunctival anesthetic injections which may cause disturbance. Frequently patients operated on by me on Saturday go to school or back to work on Monday. Many superior rectus shortenings wear no dressing at all and go about as though nothing had happened. This is done to favor binocular balance and not as a "stunt."

Infections have been rare since I have used rubber dam mounted on the speculum to protect the shorteners from contamination by the lids and lashes. Contrary to Dr. Peter's ideas I have felt that the shorteners act as capillary drains to the tendon and thus lessen the chance of infection. In general surgery a capillary drain to an infected area when covered by a moist dressing tends to remove serum and pus as it forms. Why should this principle of action be reversed in connection with my operation?

3. Concerning the occurrence of adhesions between the sclera and point of shortening. In a personal letter to Dr. Peter explaining that this does not occur and that its absence is one of my chief claims I asked if he had seen such an occurrence or if his opinion was purely theoretical. He replied that he had *not* seen it but that he *knew* that it must occur. Many times I have reshortened tendons and have yet to find such an adhesion. The adhesions are all in the tendon and render very difficult the making of strips for shortening. I have always felt that the normal action of the eyes and muscles prevents their formation between sclera and tendon.

Naturally I feel that actual experience in this, as well as in the other points mentioned, is superior to theoretical assumptions based on experiences with entirely different types of shortenings.

Very truly,
Roderic O'Connor.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy and embryology

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4. OCULAR MOVEMENTS

Pischel, D. K. **A method of muscle shortening which has rarely been used in Europe.** Zeit. f. Augenh., 1933, v. 80, June, p. 351.

The O'Connor cinch operation is clearly described and made obvious by very instructive illustrations.

F. Herbert Haessler.

Tupinamba, Jacques. **Temporary paralysis of internal rectus during Meller operation.** Rev. de Ophth. de São Paulo (Brazil), 1933, v. 2, June, pp. 269-270.

During extirpation of the lacrimal sac, with injection of four percent novocaine solution at the upper inner angle of the orbit, the patient developed paralysis of the internal rectus muscle on the same side. The disturbance was evidently due to the anesthetic having reached the branch of the motor oculi which supplies the internal rectus, for two days later the function of the muscle was normal. W. H. Crisp.

5. CONJUNCTIVA

Avizonis, P. **The early clinical diagnosis of trachoma.** Zeit. f. Augenh., 1933, v. 81, July, p. 1.

The clinical manifestations of incipient chronic trachoma are: (1) diffuse thickening of the conjunctiva of each fornix or a thickened roll of conjunctiva on the bulbar side of the fornix; (2) follicles in the fornices, at the ends of the upper edge of the tarsus of the upper lid in the plica semilunaris, and on the adjacent conjunctiva; (3) sand-like pale yellow elevations in the conjunctiva tarsi (initial follicle); (4) dull lusterless surface of the conjunctiva, which is slightly thickened; (5) velvety appearance of the conjunctiva over the convex border of the tarsus; (6) sleepy appearance of patient, with unequal lid slits. Occasionally trachoma begins with an acute conjunctivitis.

F. Herbert Haessler.

Bussola, E. **Hematological and capillaroscopic researches in trachoma.** Rassegna Ital. d'Ottal., 1933, v. 2, March-April, p. 211.

Bussola made careful studies of the blood and with the capillaroscope in one hundred cases of trachoma. He concludes that trachoma is a manifestation of a chronic disturbance in a person of lymphatic constitution. In forty-six percent of the cases there was a slight decrease of hemoglobin; in forty-four a slight erythropenia; in forty-three percent a leucopenia; polynuclears increased in sixty-five percent; and eosinophilia in fifty-eight percent; with

variable lymphocytes. The capillaroscope revealed no constant change in vascular function. (Four illustrations.)
Eugene M. Blake.

Cuénod, A., and Nataf, R. **Vital staining and biomicroscopy of the conjunctiva.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 86.

The coloration obtained is very superficial, involving only the outer layers of epithelium. Only cells which are about to be desquamated stain intensely, which explains why the normal conjunctiva is much more difficult to stain than the diseased. The biomicroscopic appearance after vital coloration of normal conjunctiva, trachomatous conjunctiva, and that of vernal catarrh is described. In trachoma the epithelium over the follicles and over the spaces between the papillae stains poorly or not at all. Generally speaking the authors believe that study of vitally stained conjunctiva offers very little advantage over that without coloration.
Phillips Thygeson.

Gabriélidès, C. A. **A microorganism recovered from human conjunctiva for the first time.** Ann. d'Ocul., 1933, v. 170, Aug. pp. 683-689.

A gram-positive bacillus was found in material taken from a conjunctivitis following removal of a pterygium.
H. Rommel Hildreth.

Garau, B. **Development of conjunctivitis in relationship to the months of the year and the bacteriologic findings.** Lettura Oft., 1933, March, p. 107.

The author classifies clinically 1235 cases of conjunctivitis observed in the scholastic year 1927-1928. Trachoma existed in 72.5 percent of the cases, with greater prevalence in January, February, and March. Koch-Weeks was present in 5.5 percent of the cases, showing greater frequency in January and February. The diplobacillary cases, 7.7 percent of the total, showed greatest prevalence in April, June, and July. The pneumococcus of Frankel was found in 4 percent, most numerous in January. (Bibliography)
F. M. Crage.

Giani, P. **Histopathology of conjunctiva and cornea in trachomatous pannus.** Rassegna Ital. d'Ottal., 1933, v. 2, March-April, p. 336. (See Section 6, Cornea and sclera.)

Gonzalez, J. de J. **A study of nuclear inversion in cases of phlyctenular kerato-conjunctivitis.** Rev. Cub. Oto-Neuro-Oft., 1932, v. 1, July-Aug., p. 221.

Thirty cases of phlyctenular kerato-conjunctivitis were studied with reference to the Arneth count and the Velez sign. Only two exhibited nuclear inversion and both subsequently developed frank tuberculous lesions, one in the eye and the other in the lungs. The writer concludes that phlyctenular kerato-conjunctivitis is not a tuberculous lesion and does not indicate a predisposition to tuberculosis. The blood studies, on the other hand, revealed frequently mononucleosis, and the writer queries whether it is an expression of lymphatism or endocrine inbalance.
M. Davidson.

Hartman, K. **Peritomy for prevention of gonorrheal corneal complications.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 249.

A man aged twenty-one years had very severe gonorrheal conjunctivitis of the right eye, leading, in spite of local and milk treatment and peritomy, to perforation of the cornea with prolapse of the iris. Although in very severe cases peritomy does not prevent corneal ulcer, the author recommends it in cases in which milk therapy fails.
C. Zimmermann.

Löwenstein, Arnold. **Nodules in cornea and conjunctiva and their relation to Aschoff's rheumatic nodules.** Zeit. f. Augenh., 1933, v. 81, July, p. 19.

In tuberculous individuals with and without eye affections one frequently sees in cornea and conjunctiva transient nodules which contain lymphocytes, fibroblasts, giant cells, and necrotic areas in which no tubercle bacilli are found. Tuberculous individuals often react with similar nodules to instillation of tuberculin into the conjunctival sac. In rabbits similar phenomena are

observed after specific and nonspecific preparatory injections. Anatomical studies have shown that the entire mesenchyma may be the seat of such nodules in recurrent arthritis. Injections into the joints in sensitized animals produce typical nodules throughout the mesenchymal tissues. It is likely that human arthritis is a similar reaction and that the source of the sensitization is to be found in the tonsil. The subepithelial conjunctival nodules, the transient ones as well as phlyctenules, are analogous to the Aschoff bodies found in arthritis.

F. Herbert Haessler.

Pascheff. **Vegetations of the cornea with symblepharon in advanced vernal catarrh.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 97.

A man aged fifty-four years had limbal and corneal vegetations which involved both eyes and almost completely covered the corneas. The upper fornices were shortened and the tarsal conjunctivas cicatrized, and there was a symblepharon involving the superior cul-de-sac of the left eye. Biopsy of vegetations from the right cornea showed flattening and stratification of the epithelium, partial destruction of Bowman's membrane, marked vascularization, and infiltration consisting mainly of plasma cells. In the cornea there was very little connective tissue proliferation but this increased near the limbus. Papillary hypertrophy at the limbus was very marked. The author regards the case as one of mixed trachoma and spring catarrh.

Phillips Thygeson.

Pergola, A. **Cystic tumors of the conjunctiva.** Lettura Oft., 1933, April, p. 159.

A large conjunctival cystic tumor was found in a young man of twenty-two years. The tumor mass had been noted for about ten years. Histologic examination suggested that the cyst was due to invagination of epithelium resulting from chronic progressive conjunctivitis. (Bibliography)

F. M. Crage.

Redding, L. G. **The use of foreign protein in the treatment of ophthalmia neonatorum and gonorrheal ophthalmia.** Pennsylvania Med. Jour., 1933, v. 36, May, p. 582.

Redding now uses only human mother's milk, freshly and aseptically drawn but not boiled, 1 c. c. being injected daily into an infant. He believes these patients would do as well without local treatment except for cleansing. Since the use of this agent the author has never lost an eye that did not already have an ulcer when first seen, and no ulcer has developed in a case in which the cornea was unbroken when first seen.

The reviewer suggests that no differentiation is made between gonorrheal and nongonorrheal cases, that treatment is started before a smear is positive, and that no table is given as to how many ever showed a positive smear.

Ralph W. Danielson.

Remky, Erich. **Posterior embryotoxon in congenital hydrophthalmos with apparent aniridia at birth.** Zeit. f. Augenh., 1933, v. 81, July, p. 48.

A peripheral annular corneal opacity which arises in the region of Descemet's membrane and extends anteriorly as a wedge was observed in the eye of an infant. At the time of the first observation aniridia was thought to be present but subsequently the iris became visible. The author speculates as to the possible morphogenesis of such annular corneal opacities.

F. Herbert Haessler.

Solus, Robert. **Folliculosis of the conjunctiva in aleukemic lymphadenosis.** Med. Klin., 1933, v. 29, July, p. 906.

The author reports results thirteen years after the treatment in a case of folliculosis associated with aleukemic lymphadenosis.

The upper and lower lids were covered with follicles 1 to 2 mm. in diameter, many of which were confluent, the lower lids being more severely involved. The follicles extended along the convex border of the tarsus to the angles, and into the transitional folds. They were light gray in color and not transparent,

some round, others elongated, and all flattened, in a pale conjunctiva. In the general examination the preauricular, cervical, cubital, and axillary glands were enlarged. The spleen was somewhat enlarged, the liver only slightly. Thickening of the lids caused a ptosis. In the blood, the lymphocytes varied from forty to seventy-nine percent; blood pressure was 150/70, weight 92.5 kilograms.

The follicles were expressed as in trachoma, but recurred in larger size within three weeks. After roentgen treatments over the spleen, the conjunctival follicles became smaller (without local treatment) and in a few weeks the conjunctiva was normal, and it had remained so up to the last examination in 1932. Beulah Cushman.

Thygeson, Phillips. **Rôle of Bacterium granulosis in trachoma.** Arch. of Ophth., 1933, v. 10, July, pp. 1-5.

The author describes the results of two experiments. The first was the inoculation of the conjunctiva in five humans with cultures of three fresh strains of Bacterium granulosis, the pathogenicity of which had previously been tested on the conjunctiva of the macacus rhesus monkey. In none of these subjects did evidence of trachoma develop. In the second experiment, two humans were inoculated with follicular material from infected monkeys, both cases developing a mild follicular conjunctivitis which subsided without treatment. The author is inclined to believe that Bacterium granulosis conjunctivitis and experimental trachoma are not identical and that Bacterium granulosis is not the etiological agent in trachoma. (For fuller summary see Amer. Jour. Ophth., 1933, v. 16, Oct., p. 930.) M. H. Post.

6. CORNEA AND SCLERA

Addario La Ferla, G. **Efficacy of Elliot trephining with iridectomy in grave corneal ulcers.** Lettura Oft., 1933, April, p. 181.

When actual cautery of the ulcer, accompanied by agents intended to remove conjunctival or lacrimal infection, has failed, the author performs a superior 2 mm. limbal trephining (Elliot). The ulcer heals because of removal of toxins, the relief of lymphatic stasis, and introduction of immunizing substances. F. M. Crage.

Allen, T. D. **On the pathology of bullous keratitis.** Trans. Amer. Ophth. Soc., 1932, v. 30, pp. 391-419.

From microscopic study of thirty specimens the author concludes that the essential pathology is an unknown change in Bowman's membrane which interferes with its giving a foothold to the epithelial cells, and often to the connective tissue which grows between them. If treatment of the cause of the primary condition fails, removal of Bowman's membrane is indicated. A man of sixty-six years had a recurrent ulcer for two years. A bulla developed and the writer removed Bowman's membrane. The pain disappeared and there was no recurrence.

C. Allen Dickey.

Ammann, E. **Traumatic superficial interstitial keratitis.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 253.

The six cases described occurred in elderly men after slight injuries. The whole thickness of the cornea was involved with swelling of the epithelium. In the further course Descemet's membrane showed opaque stripes. The iris became involved early. The affection lasted from four to eight months and terminated badly, as the cornea remained opaque with vision reduced to counting fingers. The impression given was of anaphylactic inflammation.

C. Zimmermann.

Bistis. J. **A contribution to the tuberculin therapy of uveitis and scleritis.** Zeit. f. Augenh., 1933, v. 80, May, p. 250. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Farina, Ferdinando. **Perforating apical galvanocauterization at one step as surgical treatment of keratoconus.** Lettura Oftalmologica, 1933, 9th year, Jan., p. 25.

A single perforating galvanocauterization at the apex of the cone brought the following results at the end of two

months: improvement of vision from 1/30 to 5/10 (with —3.00 sph.), minute leucoma, no disturbance of the pupil, good regularity of corneal curvature (Placido disc), and no alteration in tension, 20 mm. (Schiötz). The author concludes that this is the method and is of preference for immediate as well as stable result.

F. M. Crage.

Filatow, W. F. **Suggestions for corneal transplantation.** Arch. f. Augenh., 1933, v. 107, May, pp. 152-162.

Filatow gives technique for various types of corneal transplantation with suggestions for postoperative care.

Frederick C. Cordes.

Fradkine, J. **Three cases of superficial punctate keratitis. Etiology and therapy.** Bull. Soc. Franç. d'Opht., 1932, p. 135.

Fradkine believes that influenza is the most frequent cause of superficial punctate keratitis. He describes three cases occurring during an influenza epidemic in 1932. Antibacterial therapy with "septicémine" and sodium salicylate gave rapid and complete healing, whereas local treatment was ineffective.

Phillips Thygeson.

Giani, P. **Histopathology of conjunctiva and cornea in trachomatous pannus.** Rassegna Ital. d'Ottal., 1933, v. 2, March-April, p. 336.

Giani studied histologically the conjunctiva at the limbus and nearby parts in seven cases of trachomatous pannus. One of the most important anatomopathological changes in the conjunctiva of the lids and fornices is infiltration of the adenoid layer by small round cells. Lymphocytes and plasma cells are particularly abundant about the follicles and papillae. The principal change in the cornea with pannus is a small-celled infiltration, with lymphocytes and plasma cells localized between the epithelium and Bowman's membrane and between Bowman's and the substantia propria. (Two illustrations.)

Eugene M. Blake.

Gonzalez, J. de J. **A study of nuclear inversion in cases of phlyctenular kerato-conjunctivitis.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, July-Aug., p. 221. (See Section 5, Conjunctiva.)

Kuhn, R., and Brockmann, Hans. **The influence of carotin on growth, xerophthalmia, colopokeratosis and estrual cycle.** Klin. Woch., 1933, v. 12, June 24, p. 972.

The authors discuss the relation of three hydrocarbons, alpha, beta, and gamma, that have been isolated in vitamin "A" and the effect of the different ones on the growth of rats.

In xerophthalmia there was no difference in the healing effect of the different forms except in a quantitative way. Beta carotin seems to be twice as effective as alpha and gamma carotin.

In a deficiency the estrual cycle is interrupted, but it is reëstablished with the giving of gamma and beta carotin in larger doses than are necessary to cure xerophthalmia, and with increasingly larger doses there is a direct storing of vitamin "A" in the liver.

Beulah Cushman.

Löwenstein, Arnold. **Nodules in cornea and conjunctiva and their relation to Aschoff's rheumatic nodules.** Zeit. f. Augenh., 1933, v. 81, July, p. 19. (See Section 5, Conjunctiva.)

Mann, Ida. **On congenital hyaline membranes on the posterior surface of the cornea.** Brit. Jour. Ophth., 1933, v. 17, Aug., p. 450.

The literature records few such cases. The author has observed the condition with the slitlamp in five eyes and has traced two doubtful cases. The central part of the cornea is normal all through, and the epithelium and substantia propria are entirely normal. But in the periphery a semitransparent hyaline membrane appears applied to the posterior surface of the cornea, involving part or the whole of the circumference. In most of the series the iris displayed thick coarse strands of stroma extending from the pupil margin to the periphery. Visual acuity was good, and there were no symptoms. The condition may be postnatal or of purely embryonic origin. (Six illustrations.)

D. F. Harbridge.

Pascheff. **Vegetations of the cornea with symblepharon in advanced vernal catarrh.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 97. (See Section 5, Conjunctiva.)

Sanguinetti, C. **Corneal ulcers in the reaper.** Lettura Oft., 1933, 9th year, Feb. p. 79.

Thirty-seven cases of corneal ulcer in reapers during the harvest season of 1932 are discussed. The cases ranged from simple ulcer to severe necrosis with perforation and panophthalmitis. Nineteen were in females and eighteen in males.

The corneal ulcer of reapers which tends to become serious if neglected seems to be caused by the usual pathogenic bacteria found in the conjunctival sac, namely pneumococcus, streptococcus, and staphylococcus, as demonstrated by Calderaro, who found these organisms on the beards of the grain. The streptothrix is mentioned as entering the abraded cornea and preparing the way for the pneumococcus.

F. M. Crage.

Seefelder, R. **Interstitial keratitis in congenital lues.** Arch. f. Augenh., 1933, v. 107, May, pp. 116-141.

Interstitial keratitis followed superficial corneal abrasion. The child, a congenital luetic, died during the acute stage of the disease. Examination of the cornea for the presence of spirochetes was negative. The conjunctiva, episcleral tissue and sclera showed primarily a perivascular inflammation with round cells and an occasional polynuclear cell. Seefelder feels that the presence of the spirochete in the eye plays no rôle in interstitial keratitis. Microphotographs.

Frederick C. Cordes.

Van Manen, J. G. **The use of Wessely's steam cautery in corneal herpes.** Arch. f. Augenh., 1933, v. 107, May, p. 254.

Van Manen used this cautery on thirteen patients and feels it can be highly recommended in recent cases.

Frederick C. Cordes.

7. UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Adler, F. H. **Is the aqueous humor a dialysate?** Arch. of Ophth., 1933, v. 10, July, pp. 11-19.

The experiments undertaken were to determine the concentration of urea in the aqueous and blood of cats, the fluids being withdrawn simultaneously, and the Van Slyke gasometric method being used. The concentration of urea in the aqueous was about eighteen percent less than in the blood. If the aqueous were a true dialysate, the urea concentration of the blood and aqueous would be the same. The author concludes that the membrane separating the aqueous from the blood is not an inert semipermeable membrane and that the aqueous humor cannot therefore be a dialysate.

M. W. Post.

Avalos, A. **Severe bilateral uveitis with grayness. A new case of severe bilateral uveitis with deafness, baldness, and grayness.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, July-Aug., pp. 238 and 242 (two articles).

Two cases are reported of the entity described by Koyanagi and both are attributed to lues. M. Davidson.

Bistis, J. **A contribution to the tuberculin therapy of uveitis and scleritis.** Zeit. f. Augenh., 1933. v. 80, May, p. 250.

Brief case reports of ocular disease which responded favorably to tuberculin therapy are presented.

F. Herbert Haessler.

Hambresin, L. **Mobile cyst of the anterior chamber.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 145.

This cyst occurred in a patient of fifty-eight years. The eye had ten diopters of myopia and a retinal detachment. The cyst occupied the angle of the chamber, but by turning the head it could be displaced through an arc of 180 degrees. Hambresin suggests that the cyst may have arisen from the pigment epithelium of the posterior face of the iris. Phillips Thygeson.

Hambresin, L., and Coppez, J. H. **Unilateral diplocoria with hypertonus.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 154.

In a woman of fifty-two years, with tuberculous antecedents, unilateral atrophy of the iris had occurred at the age of twenty years, without pain or inflammatory signs. It resulted in the formation of a second pupil. Twenty-nine years later secondary glaucoma developed. The authors believe that the glaucoma was secondary and not causal and resulted from destruction of iris tissue. Phillips Thygeson.

Jaensch, P. A. **A clinical contribution to the question of separate pupilomotor fibers in the optic nerve.** Zeit. f. Augenh., 1933, v. 81, July, p. 35.

Twelve patients had amaurosis with intact pupillary reactions or inactive pupils with good central vision. The author concludes that the clinical evidence as well as that obtained by anatomical and physiological studies points to the existence of separate pupilomotor fibers.

F. Herbert Haessler.

Kirby, D. B., and Wiener, R. von E. **Changes in the concentration of dextrose in human aqueous humor and blood:** study 3. Arch. of Ophth., 1933, v.10, July, pp. 28-36.

In twenty-five nondiabetic patients with cataract, average age 56 4/5 years, the average dextrose content of the aqueous was 103.2 mg. per 100 c.c., the average dextrose content of the whole capillary blood 120 mg., making the ratio of aqueous dextrose to blood dextrose 0.82. In twenty-three diabetic patients with cataract, average age 58 4/5 years, the average dextrose content of the aqueous was 124.3 mg. and the average dextrose of the blood 146, making the ratio 0.83. In a third series of twenty-seven patients, aqueous was drawn at various periods. The average concentration of the dextrose in the aqueous during fasting in five cases was 28 mg., which increased to 109 mg. after ingestion of dextrose. The increase in the capillary blood during this same period was considerably greater, being eight percent of its fasting value. It was also noted that after insulin reaction tests with a rapid fall in blood dextrose it was possible for the aqueous dextrose to have for a time a higher content than the blood dextrose. M. H. Post.

Kunz, E. **On iritis in chronic spondylarthritis ankylopoietica.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 153. (Ill.)

Seven cases of iritis in spondylarthritis ankylopoietica are reported. Probably this affection of the vertebral column is a type of chronic articular rheumatism. C. Zimmermann.

Moore, R. F. **The nonluetic Argyll Robertson pupil.** Trans. Ophth. Soc. United Kingdom, 1931, v. 51, pp. 203-209.

The author described seven cases under this heading in 1924 (Trans. Ophth. Soc. United Kingdom, 1924, v. 44, page 38) and to these he now adds eight. The condition is usually uniocular, seems to be nonprogressive, is not related to any constitutional disease or other nervous disorder including syphilis, and is more common in females. It apparently begins early in life; one person lived forty-seven years after it was discovered, without manifesting any other disease. The special features of these pupils are that they are larger than normal, do not contract to light directly or consensually, contract slowly to convergence, and afterward relax slowly; they can be dilated with atropin, and in each of two cases both pupils contracted fully to eserin.

Thomas D. Allen.

Passow, A. **Horner's syndrome, heterochromia and status dysraphius, a symptom complex.** Arch. f. Augenh., 1933, v. 107, May, pp. 1-51.

Of fifty-six patients with status dysraphius fifty-three had Horner's syndrome or heterochromia, and in some instances both. The number and degree of symptoms varied from very slight to those suggestive of syringomyelia. In women, as a rule, the breast on the side of the Horner syndrome and heterochromia was smaller and had less pigment surrounding the nipple. Passow concludes that Horner's syndrome,

heterochromia, and status dysraphius constitute a symptom complex, having as its anatomical basis partial embryonal cavity formation and gliosis; changes that speak for syringomyelia of the cervical and upper thoracic cord or the presence of syringobulbia in the medulla oblongata.

Frederick C. Cordes.

Rinaldi, S. **Clinical research on the antigenic properties of uveal pigment.** Annal. di Ottal., 1933, v. 61, April, p. 268.

Bovine uveal pigment was introduced intradermally in 130 cases of injury, including uveal and corneal injuries, contusions, panophthalmitis, septic endophthalmitis, and acute inflammatory glaucoma, as well as normal eyes. Slightly increased sensibility was found in those eyes with uveal involvement, but in two cases of sympathetic ophthalmia the results were negative. (Bibliography.) Park Lewis.

Rinaldi, S., and Quaglio, C. **Intradermatization of uveal protein in affections of the uvea.** Annal. di Ottal., 1933, v. 61, April, p. 295.

The authors attempted to demonstrate that in uveal affections there existed a special sensitivity to intradermal injection of a watery extract of the bovine choroid deprived of its pigment. Their conclusion negatives this view. Park Lewis.

Roche, C. **Some reflections on three cases of sympathetic ophthalmia.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 158.

In the first case the ophthalmia supervened nine and a half years after the wound. In the second case the disease occurred seven weeks after cataract extraction complicated by small iris prolapse which had necessitated cauterization. The third case also followed cataract extraction, this time complicated by mild iritis, the disease appearing in the sympathizing eye thirteen days after the operation.

Phillips Thygeson.

Samuels, Bernard. **Sympathetic scleritis.** Arch. of Ophth., 1933, v. 10, Aug., pp. 185-197.

No previous effort has been made to determine the rôle played by the sclera in sympathetic ophthalmia. The findings in ninety-four cases are tabulated. Involvement was most likely at the posterior pole about the disc and macula, probably due to closer association between the choroid and sclera in this region and the greater frequency of the emissary vessels, the posterior ciliary arteries and nerves.

Of all cases studied about seventy-five percent showed involvement of the sclera, with infiltration in the walls of the emissary vessels in forty-five, and involvement of the stroma in forty-one. Because of the severity of the scleral involvement, certain cases may be called uveoscleritis. In no other disease is the sclera so subject to involvement. The severe pain occasionally met with is probably due to accompanying scleritis and tenonitis. M. H. Post.

Schreiber, Z. **Time of development and disappearance of Argyll Robertson pupil.** Zeit. f. Augenh., 1933, v. 81, July, p. 66.

In the course of eight days a typical Argyll Robertson pupil developed in a patient who at the beginning was observed to have minimal anisocoria and prompt pupillary response to light. Progressive paralysis was diagnosed by the neurologist consulted. Typhoid vaccine was injected to produce fever, since malaria was considered contraindicated. Fifteen days later, after the seventh febrile period, the pupils began to react sluggishly to light, and four days later they were completely normal. Seven months later the patient was still normal generally as were also his eyes.

F. Herbert Haessler.

Van Lint. **Traumatic episcleral abscess with restricted regional iritis. Pathogenesis of sympathetic ophthalmia.** Arch. d'Opht., 1933, v. 50, July, p. 449. (See Amer. Jour. Ophth., 1933, v. 16, June, p. 562.)

Villard, H., and Dejean, C. **Multiple cysts of both pupils, hereditary and familial. Their embryologic significance.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 148.

These multiple cysts were seen in a woman of twenty-nine years. They were brown, thin-walled, and filled with clear fluid. The walls were probably thin uveal tissue derived from the posterior pigment layer of the iris to which they were attached by small pedicles. The mother and a brother had similar cysts. The authors suggest that the cysts were formed at the expense of an annular sinus which had developed abnormally and persisted into adult life. Phillips Thygeson.

8. GLAUCOMA AND OCULAR TENSION

Ascher, K. W. **Relations between intraocular pressure and volume of the eyeball.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 208. (Ill.)

Ascher describes his apparatus (manufactured by Diel, Leipzig) for measuring the volume of the globe, based on the principle of displacement of fluid, which allows of a prompt and sufficiently exact determination of volume. He notes that upon experimental diminution of intraocular pressure the volume of the eyeball may increase or decrease. The author agrees with Aldrich, who attributed this paradoxic phenomenon to inflammatory changes in the ocular wall.

C. Zimmermann.

Biffis, A. **The alkalinity of the blood in the glaucomatous.** Annal. di Ottal., 1933, v. 61, Feb., p. 109.

In the normal subject the alkaline reserve in the blood varies from 70.45 to 51.33, with a mean of 60.21. Seventy patients were examined, of whom twenty had normal eyes and fifty were glaucomatous. In those affected with primary glaucoma the pH ranged from 77.7 to 50.5, with an average of 62.31. This was within normal limits with a slight tendency toward alkalinity. The author considers that this may contribute to an explanation of some of the manifestations of glaucoma. The results appear, however, to be negligible. (Bibliography.) Park Lewis.

Biffis, A. **The proportion of calcium and potassium in the blood of the glaucomatous.** Annal. di Ottal., 1933, v. 61, April, p. 284.

The proportions were determined in the blood of twenty normal subjects and in fifty having glaucoma. Calcium deficiency in the ocular contents determines a diminished osmotic pressure and consequently an enrichment of the aqueous. The same action is provoked by augmentation of potassium. A quotient K:C superior to the normal tends toward parasympathicotonia with augmented permeability of the capillaries controlled by the vegetative nervous system. The incidental alkalinity of the ambient humoral cells accords with Meesmann's concept that glaucoma develops in an alkaline condition of the liquids of the organism. (Bibliography.)

Park Lewis.

Coppez, L. **The treatment of glaucoma in the universities of Holland.** Bull. Soc. Belge d'Opht., 1933, no. 66, p. 27. (Report for the Hermans Prize, 1932.)

Acute glaucoma: The French regard acute glaucoma as always requiring urgent surgical intervention, i.e., iridectomy. The four universities of Holland, as well as the University Clinic of Brussels, always begin treatment of the hospitalized patient with massive doses of pilocarpin. Usually the tension falls after a few hours, when an iridectomy with broad base is performed through a scleral incision. The use of aminglaucosan is rejected.

Chronic glaucoma: Pilocarpin is universally employed in medical treatment. The most generally used surgical treatment is Elliot's trephine operation. Lagrange's sclerectomy is not generally practised because the technique is considered too difficult. Zeeman (Amsterdam) practices a modified Elliot operation. Secondary infections are very rare. The best results are those in which there is no bleb, but the intraocular fluid spreads freely under the conjunctiva. Zeeman reserves cyclodialysis for certain special cases: (a) cases in which two or three Elliot operations have failed (the cyclodialysis is not regarded as final but as effective for one or two years); (b) cases in which there are numerous adhesions of the iris or a very thin conjunctiva; (c) cases in children

of over three years with very large globe and deep anterior chamber.

Van der Hoeve (Leyden) practices the Elliot operation with a very large conjunctival flap, repeating the operation several times if necessary. Rochat (Groningen) and Weve (Utrecht) practice the Elliot operation exclusively.

Secondary glaucoma: Under this classification are considered only the hypertonies due to an inflammatory process in evolution, such as iridocyclitis. In this Zeeman prefers levoglaucosan if the classic methods of treatment fail. Van der Hoeve regards glaucosan as unreliable and prefers the classical procedures, Rochat is a strong partisan of levoglaucosan and Weve uses levoglaucosan as a routine but sometimes uses a 1:250 solution by iontophoresis.

Absolute glaucoma: Retrobulbar injection of alcohol is not practised in Holland, but enucleation is considered most favorable and least dangerous.

Infantile glaucoma: The Elliot operation is choice for children of less than two years. For older children presenting considerable buphthalmos with a large anterior chamber and thinning of the limbus and conjunctiva, Zeeman prefers cyclodialysis. Weve practises a new operation not yet published, "transcleral diathermo-coagulation."

J. B. Thomas.

Holth, S. **Atropin contraindicated both before and after iridencleisis for glaucoma.** Arch. d. Ophth., 1933, v. 9, June, p. 913-914.

In this brief note, the author states that atropin is never used in the eye clinic at Oslo by Dr. Gjessing or himself after this operation. Ten percent cocaine is preferred. M. H. Post.

Lacat, C. **Concerning the medical treatment of glaucoma.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, July-Aug., p. 235. (See Amer. Jour. Ophth., 1932, v. 15, Nov. p. 1090.)

Poos, F. **Clinical observations on fistulizing eyes.** Arch. f. Augenh., 1933, v. 107, May, pp. 163-171.

One eye had a congenital defect, in the other the condition resulted from trauma. Upon waking, the tension was approximately 20-23 mm. Hg., but in the course of the day the tension dropped to 7-8 mm. The curve showed very little variation over a series of days. When the lids were held away and the patient looked down the tension dropped rapidly, but upon closing the eyes it rose again. In two glaucomatous patients with fistula after trephining, a similar phenomenon was observed. The observation that trephine operations in the area of the lid aperture often produce hypotony, Poos feels, can be explained by his observations.

Frederick C. Cordes.

Sédan, Jean. **Contribution to the study of regulation of ocular tonus.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 165.

The right eye of a stevedore aged thirty-six years had received a knife wound through the cornea six years previously. There was traumatic cataract, low-grade uveitis, and occlusion of the pupil, with secondary glaucoma. Three attempts at iridectomy failed, the opening closing each time. Hypotonus then developed and continued for more than a year. A fourth iridectomy resulted in return of normal tonus and increased visual acuity.

Phillips Thygeson.

Zappino, J. Z. **Injections of stabilized sodium iodide in glaucoma and other painful eye diseases.** Rev. Cub. Oto-Neuro-Oft., 1932, v. 1, July-Aug., p. 248.

As an analgesic, regardless of other treatment, the use of injections of stabilized one percent sodium iodide (apparently a proprietary preparation) in the supraorbital or temporal region of the affected side has given the writer gratifying results, and its retrobulbar injection, in lieu of alcohol, for the relief of pain in certain cases of glaucoma is suggested. M. Davidson.

9. CRYSTALLINE LENS

Appleman, L. F. **Intracapsular cataract extractions by the Knapp method: a report on one hundred cases.** Arch. of Ophth., 1933, v. 9, June, pp. 907-912.

One hundred and eighty eyes in all were operated upon in order to secure

one hundred by the intracapsular method, that is 55.55 percent of the total. The Kalt forceps was used to grasp the capsule. Traction was made upward and from side to side until the lower periphery of the lens came into view. The forceps was then released, and with the Smith hook or curved spoon, while counterpressure was made on the posterior lip of the corneal wound, the lens was made to tumble, care being taken that the instrument following the lens upward from below was kept in close contact until delivery, thus preventing prolapse of vitreous into the wound. There were 81 mature, 17 immature, one nuclear and 2 hypermature. Vitreous was lost in 6 cases, there was striate keratitis of short duration in 5, iridocyclitis in 2, hyphema from injury in 4, and detachment of the retina in 3. M. H. Post.

Barraquer. **Accidents and complications in total extraction of senile cataract.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 179.

This paper is translated in the American Journal of Ophthalmology, 1933, v. 16, p. 385.

Blaskovics, L. **Improvement of unsuccessful cataract operations.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 145. (Ill.)

In 1909 the author described methods for remedying ectatic scars, incarceration of iris capsule or vitreous, cystoid scars, and tough secondary cataract. For the first condition a new limbal incision is made similar to the original cataract incision but carried through so as to include the ectatic scar in the corneal flap, and the ectatic scar is then excised. Further procedures are described for sectioning a high iris coloboma pillar, for freeing an adherent zonula, for releasing pupillary synechia, and for removal of dense secondary membrane. C. Zimmermann.

Frenkel, H. **Concerning Vossius annular contusion cataract.** Rev. Cub. Oto-Neuro-Oft., 1932, v. 1, May-June, p. 154. (See Amer. Jour. Ophth., 1932, v. 15, Nov., p. 1109.)

Kirby, D. B., and Wiener, R. von E. **Carbohydrate tolerance in elderly patients with cataract:** study 2. Arch. of Ophth., 1933, v. 10, July, pp. 25-27.

Sixty-four cases were studied. The tolerance curves were classified in four groups: (1) normal for old age, (2) lag type, (3) acicular type, and (4) diabetic type.

"Lag type" denotes delay in metabolism of ingested dextrose, indicating a slowing up in the removal of the sugar from the blood by the tissues and liver. The "acicular type" denotes rapid rise of capillary blood sugar, followed by equally rapid return. In the diabetic type, a high peak is reached at the hour or hour-and-a-half interval and at the end of the test period, and return to normal is incomplete. Of the 64 patients examined, 57 with senile cataract and 7 with other ocular conditions, 29 had the diabetic type of curve; 17 had the lag type; 8 had the acicular type, and 11 had curves normal for the age. Hyperglycemia in elderly people with cataract may be merely another expression of diminished function of old age. Prevention of abnormal increase in blood sugar by proper diet may aid in maintenance of lens transparency. M. H. Post.

Kirby, D. B., Keith, C. E. and Wiener, R. von E. **Effect of changes in medium on cultures of lens epithelium:** study 4. Arch. of Ophth., 1933, v. 10, July, pp. 37-41.

A concentration of 861 mg. of dextrose in 100 cubic centimeters killed the tissue in forty-eight hours. Of fructose 660 mg., and of galactose 533 mg., killed the tissue in forty-eight hours. Of acetone 40 mg. and of beta-oxybutyric acid 120 mg. per one hundred cubic centimeters of medium killed the tissue in forty-eight hours. Since these concentrations are met with in moderately severe diabetes, the authors feel that the ketone bodies may have some bearing on lens changes in this condition. M. H. Post.

Knapp, Arnold. **Intracapsular operation for cataract.** Arch. of Ophth., 1933, vol. 10, July, pp. 6-10.

The results of the fourth hundred of successive intracapsular cataract extractions with follow-up for from three to six years are reported. These were classified as 20 hypermature, 28 mature, 30 immature, and 20 complicated. The mode of extraction was by tumbling in 97 cases. The resulting vision in 51 of the 78 uncomplicated cases was 20/20, and in 27 cases 20/30. A list of the complications encountered, both immediate and late, is presented. There was loss of vitreous in five, glaucoma in five, and hyphema in eleven. Two developed retinal detachment. The technique of the operation is described in some detail. M. H. Post.

Tooke, Frederick. **Dislocation of the ring of Soemmering, its removal. With some notes on its pathology.** Brit. Jour. Ophth., 1933, v. 17, Aug., p. 466.

This ring, the capsular remains of a cataractous lens, contains retained cortical cells, the clear center having been created by some intentional operation. The author's is the first complete case report. A male aged forty-three years, who had been operated upon fifteen years previously for relief of myopia, lost the sight of the right eye from detachment of the retina. The left eye presented a dislocated ring lying obliquely forward and outward, partly in the anterior chamber and partly in the posterior. To recover the ring the author made a crescentic conjunctival flap above and passed the point of a Ziegler knife-needle through the hole in the ring to fix it. Then he made a small corneal incision with a narrow Graefe knife, grasped the ring with a Kalt forceps, and withdrew the knife-needle. He was able to remove the ring without loss of vitreous. Descriptions of microscopic sections; (seven illustrations.) D. F. Harbridge.

Vos, T. A. **Myotonic dystrophy with cataract.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 189. (Ill.)

A man aged twenty-eight years, affected with myotonic dystrophy, showed in each eye a rapidly maturing juvenile cataract, which was successfully extracted. The myotonic and dystrophic symptoms are described in detail, and the familial occurrence of myotonic dystrophy with cataract is shown by a family tree of five generations. C. Zimmermann.

Wolfsohn-Jaffé, Else. **Hereditary anterior capsular cataract.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 236. (Ill.)

A woman aged forty-five years had had bilateral anterior cataract since birth. Of her four children, a son aged thirteen years had anterior polar cataract of the right eye, and a daughter of eight years had anterior capsular cataract of the left eye. Probably many capsular cataracts of unknown etiology and erroneously attributed to contusions in early youth are hereditary.
C. Zimmermann.

10. RETINA AND VITREOUS

Agnello, F. **Retinitis proliferans from indirect injury to the eye.** Lettura Oft., 1932, 9th year, Oct., p. 471.

The patient, an ex-soldier, manifested left external strabismus, left pupil moderately dilated, and light reflex practically abolished. The unilateral retinitis proliferans had followed profuse retinal hemorrhage resulting from indirect trauma to the left eye. Previous history and the presence of several areas of pigmentary chorioretinitis strengthened the presumption of traumatic origin. (Bibliography.)
F. M. Crage.

Anderson, J. R. **Holes in the "posterior hyaloid-membrane" of the vitreous —report on a case.** Brit. Jour. Ophth., 1933, v. 17, Aug., p. 460.

A healthy patient showed various apertures in a vertical membrane in each vitreous, associated with cataracta complicata and fine retinochoroidal changes. As a sequel to some preexistent morbid process the vitreous shrinks and becomes detached from the retina. Through a tear clear fluid passes to fill the space behind the vitreous. The membrane may contract and form opacities which float in the degenerate vitreous; By tearing the retina it may play some part in the evolution of one type of retinal detachment. (Eleven illustrations.) D. F. Harbridge.

Bergmeister, Rudolph. **Diagnostic difficulties in tuberculous fundus lesions and their therapy.** Zeit. f. Augenh., 1933, v. 80, May, p. 229.

In a patient with an ophthalmoscopic picture interpreted as chronic uveitis, tuberculous retinal periphlebitis, and miliary tuberculosis of the retina of hematogenous origin, the intradermal tuberculin reaction was positive and under tuberculin therapy the visual acuity rose from ability to count fingers at two meters to 6/9. The rather severe focal reactions to the tuberculin injections did no permanent damage.

F. Herbert Haessler.

Braun, R. **Contribution to the maculocerebral type of hereditary degeneration of the macula lutea.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 182.

A girl of twenty-three years had vision right 1/8 left 6/60, not improved by glasses, and a central scotoma for colors. Each macula was occupied by a round focus the size of the disc, of yellowish dots and fine pigment. The temporal portion of the disc was pale. The patient was left-handed and the right facial nerve weaker than the left. Her mother and a sister had epileptic attacks. The author considers this as a border-line case between the maculocerebral and the simple macular type, according to Behr's conception of the affection.

C. Zimmermann.

Coppez, L. **Experimental adhesive choroiditis effected by means of the pyrometric electrode.** Bull. Soc. Belge d'Opht., 1933, no. 66, p. 20. (Ill.)

It has been the custom to measure the current in milliamperes. According to the writer this means nothing and experimenters should specify the size of the active electrode as well as the size, situation, and manner of application of the indifferent electrode, the length of time of application, the variety of current employed, and so on. The standard of measure is the temperature of the coagulated tissue, controlled by using the pyrometric electrode, an apparatus based on the principle of the electric thermometer. Coppez experimented on hares, making episcleral coagulations in series at 70°, 80°, and 90° centigrade.

The eyes thus treated were enucleated after intervals of a few minutes, one day, three days, four days and ten days, and were studied microscopically. As early as one day after coagulation at 90 degrees centigrade, choroidal hemorrhages and vacuoles and beginning necrosis of the sclera were noted. Parallel experiments in diathermo-coagulation were made according to the method and with the instrumentation of Safar. The tissue sections showed great destruction by this technique. The retina seemed to have veritably exploded.

Although Coppez's experiments do not justify precise application of his conclusions to the treatment of detached retina in the human eye, in which the retina is separated from the choroid by fluid, they present an impressive demonstration in favor of exact standardization of diathermo-electric current.

J. B. Thomas.

Corrado, M. **Angiospasm in the pathogenesis of retinitis pigmentosa, with a new therapeutic orientation.** Annal. di Ottal., 1933, v. 61, Jan., p. 43.

The author reports two cases treated with a new preparation, acetylcholine hydrochloride, which produces dilatation of the choriocapillaris and so augments the functioning of the retina. The subject is to be more fully treated later.

Park Lewis.

Dejean, C. **Formation of the vitreous body from the basal membranes. Its lamellar structure.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 3.

Working with a graded series of sheep embryos, Dejean traces the origin of the vitreous from two membranes, one on the outer pole of the primary optic vesicle, the other underlying the ectodermal epithelium. In a sheep embryo of 9 mm. the cavity between the lens and the retina is occupied only by these two membranes and some vascular tissue. Shortly afterward (11 mm. embryo) the first vitreous appears in an angle of this cavity, originating from the retinal membrane. The vascular layer then undergoes extension. In an embryo of 55 mm. the

avascular vitreous originates near the retina at the expense of the limiting membrane. It undergoes lamellation, the successive lamellae advancing into the vitreous cavity. In an embryo of 95 mm. there are but two points at which no vitreous is being formed, first in the region of the papilla where the limiting membrane is absent and second in the ciliary region where the membrane undergoes no change. Thus is formed a sort of funnel which furnishes the wall of the canal of Cloquet, described better as the intervitreal limiting membrane. The peripheral portion of the primitive vitreous forms the zonule of Zinn. Phillips Thygeson.

Dunphy, E. B. **Ocular manifestations of Raynaud's disease.** Trans. Amer. Ophth. Soc., 1932, v. 30, pp. 420-430.

A white girl of nine years had an attack of rheumatic fever with question of rheumatic purpura. One month later she had what was apparently an obstruction of the central retinal artery. When seen six months later the right disc showed temporal pallor. The arteries were small, and the vision was down to counting fingers. The left eye was normal. Several of the finger tips and toes were cyanotic and cold, and these was much pain in the extremities. A year after the onset the left eye became blind suddenly. The fundus picture was typical of obstructed central artery. Bilateral lumbar sympathectomy with removal of the stellate ganglion resulted in improvement of the general symptoms. (Review of literature.) C. Allen Dickey.

Goldstein, I., and Wexler, D. **Embolism of the central retinal and ciliary arteries in a case of chronic lipoid nephrosis with thrombosis of the innominate artery.** Arch. of Ophth., 1933, v. 10, July, pp. 70-75.

Occluding plugs were found in the central retinal and posterior ciliary arteries, occurring simultaneously with similar involvement of the cerebral and brachial arteries, resulting from thrombosis of the right innominate artery following arteriosclerotic disease of this vessel. The whole picture was superimposed on a long standing hypercholesterolemia. M. H. Post.

Kyrieleis, W. **A typical tuberculosis of the retinal vessels. (Periarteriitis nodosa tuberculosa)** Arch. f. Augenh., 1933, v. 107, May, pp. 182-190.

The condition followed trauma. The diagnosis was made on the appearance of the retinal vessels, the presence of tuberculous iritis, and isolated tubercles of the choroid. The patient had a very strongly positive tuberculin reaction and the lesions improved under tuberculin therapy. Frederick C. Cordes.

Mayou, M. S. **The retinal visual cells in man and fresh-water fish.** Brit. Jour. Ophth., 1933, v. 17, Aug., p. 477.

In the human retina red acid fuchsin stains strongly the cones and the cone nuclei (if carefully decolorized) in the outer nuclear layer. It also stains the rods but not the rod nuclei, and in this the author thinks that we may have a means of recognizing the difference between a rod and a cone, a thing not at all easy especially in the macular region.

The author brings out the value of Mallory's differential connective tissue stain for examining the retina, and the histology of the visual cells in pike, dace, roach, and trout. There is no true comparison between the rods and cones in the lower animals and in man. The rods and cones in the human subject are phylogenetically developed from the myoid and ellipsoid in the lower animal. (Fifteen photomicrographs.) D. F. Harbridge.

Oast, S. P. **Concerning tuberculous lesions of the retina.** Trans. Amer. Ophth. Soc., 1932, v. 30, pp. 503-527.

Oast classifies retinal tuberculosis in three types, namely; massive exudative, retinal perivascular, and infiltrative. In the first, the chief characteristic is the formation of conglomerate tubercles, which arise usually as direct extension from the choroid. In the second, recurring hemorrhages as a result of lesions in the outer vessel walls are the outstanding feature. This responds well to treatment. The principal manifesta-

tion of the third type is the formation of small whitish patches of infiltrate, raised, and situated in the fiber layer. In a case reported the writer believes the process best explained as an infectious metastasis, the etiology being the bacillus either directly or through liberation of tuberculous proteins.

C. Allen Dickey.

Rezende, Cyro de. **Detachment of the retina.** Rev. de Ophth. de São Paulo (Brazil), 1933, v. 2, June, pp. 252-268.

This is a review of the various recent methods for surgical treatment of this condition, including especially those of Sourdille, Gonin, and Safar.

W. H. Crisp.

Schaeffer, A. J. **A contribution to the study of persistent remains of the hyaloid artery.** Zeit. f. Augenh., 1933, v. 80, June, p. 321.

The author describes a number of hyaloid artery cases of rather extensive persistence. Occasionally care must be used to differentiate the structure from glioma and cysticercus. Sometimes other congenital anomalies such as coloboma and microphthalmos exist in eyes with persistent hyaloid artery. Embryonal and postnatal inflammation may leave scar tissue which is difficult to differentiate from the vascular remains. F. Herbert Haessler.

Statti, L. W. **Retinitis juxtapapillaris: report of a case.** Arch. of Ophth., 1933, v. 10, June, pp. 947-951.

Onset was sudden in a young and apparently healthy adult. Optic neuritis was extreme. The lesion was located in the anterior layers of the retina at the margin of the disc. There was no involvement of choroid or pigment epithelium. There was a constant sector defect in the field, including the blind spot and extending to the periphery. Tuberculin tests were negative.

M. H. Post.

Winternitz, R., and Stary, Z. **Chemistry of the vitreous.** Arch. f. Augenh., 1933, v. 107, May, pp. 191-201.

Winternitz and Stary studied the vitreous of freshly enucleated horse eyes. The calcium content was found to be considerably lower than that of blood serum, the magnesium content higher. The chemical structure of the vitreous was found to vary more from that of blood serum than did that of the aqueous. Frederick C. Cordes.

11. OPTIC NERVE AND TOXIC AMBLYOPIAS

Addario La Ferla, G. **Etiology and pathology of papilledema.** Lettura Oft., 1933, 10th year, Feb., p. 55.

The 52 cases examined included 16 non-inflammatory cerebral tumors, one encapsulated cerebral hemorrhage, one arachnoid serous cyst, two conglomerate tubercle neoformations, six gummata, seven due to uremia, one to frontal meningitis after acute tonsilitis, two with essential hypertension of the spinal fluid, and cases of essential serous meningitis from low grade infection and of dental granuloma. The author believes that the chief factor in the production of papilledema is purely mechanical. F. M. Crage.

Branbergen, R. T. **Ocular symptoms in ictero-hemorrhagic spirochetosis.** Arch. d'Opht. 1933, v. 50, July, p. 485.

Three patients developed a mild acute optic neuritis in the course of an icterohemorrhagic spirochetosis which arose after bathing in an open pool near the river where rats were plentiful. All recovered without visual damage. Eight cases of the disease occurred, three of which developed optic neuritis. Recognition of the optic neuritis was an aid in differential diagnosis between meningitis and the meningeal forms of icterohemorrhagic spirochetosis. These findings support the idea of Widal, who thinks that the spirochetes of this disease have a definite affinity for nerve tissue. M. F. Weymann.

Goldstein, I., and Givner, I. **Calcified hyaline deposit (Drusen) in the optic disc associated with pigmentary changes in the retina.** Arch. of Ophth., 1933, v. 10, July, pp. 76-82.

In this case there were drusen in the optic disc of the right eye and in the retina of the left. The nature of these

bodies is discussed, and their differential diagnosis from corpora amylacea and corpora arenacea. M. H. Post.

Riechert, T. **Retinitis pigmentosa and multiple sclerosis.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 163.

A man, not hereditarily tainted, showed retinitis pigmentosa and multiple sclerosis. The first eye symptoms occurred at the age of sixteen years. There was a central scotoma in each eye. The sharply defined discs were not yellow as is usual in retinitis pigmentosa, but entirely pale as in total optic atrophy. Possibly a certain hereditary inferiority of the tissues which led to retinitis pigmentosa was also the source of the especially severe optic nerve affection. C. Zimmermann.

Russell, W. R. **Hereditary aspects of Leber's optic atrophy, with a report of cases consequent upon the mating of cousins.** Trans. Ophth. Soc. United Kingdom, 1931, v. 51, pp. 187-200.

After a preliminary consideration of the theory of chromosome-borne factors, the author gives four case histories, three in one family (parents second cousins) and one a second cousin of these three. A rather complete genealogy of five generations is possible because the family has always lived on a small island and has remarkable knowledge of previous generations. Some seventy-two members of this family tree have been carefully inquired into or examined. Many lived to be septo- or octogenarians. Thomas D. Allen.

12. VISUAL TRACTS AND CENTERS

Caliceti, P. **Interventions on the hypophysis.** L'Oto-Rino-Laringologia Italiana, 1933, 3rd yr., Jan., pp. 1-33.

The author reports three hypophysectomies performed on three adults on account of hypophyseal adenoma with a chiasmatic syndrome in two patients and a mixed chiasmal and adiposogenital syndrome in the other. The technique adopted was that of Hirsch and Segura, by way of the nasal septum and the sphenoidal sinus. After submucous resection of the septum and opening the sphenoidal sinuses, before opening the sella turcica the author made two radiographs, one in lateral projection and one axial, after having introduced into the sphenoidal cavity a cotton applicator resting upon the point at which it was assumed the sella would have to be opened. After the radiographs had been made the author proceeded to open the sella, incise the dura, and remove the hypophysis by means of special instruments. In none of the three cases was it necessary to remove the middle turbinate in order to obtain access to the sphenoidal sinuses.

Immediate and remote results included rapid healing, distinct improvement of visual acuity, and in one patient improvement of the general disturbances. W. H. Crisp.

Corrado, Mario. **Remote results of roentgen ray treatment of sellar and parasellar tumors.** Annal. di Ottal., 1933, v. 61, Jan., p. 1.

Pituitary tumors may be divided into two groups, one influenced by x-ray and the other not. Cases are reported from the literature in which improvement has followed use of x-ray or radium or both combined; and cases in the second group in which no appreciable benefit followed. Three methods of operation are described: (1) puncture of the sphenoid, when the growth is cystic; (2) decompression of the sella, which will relieve the tension and combined with irradiation may be curative; (3) decompressive craniectomy, which may give temporary relief. Puncture of the corpus callosum may be dangerous and should be considered only when other measures have been discarded.

Park Lewis.

Goldmann, H., and Schubert, G. **Changes in the field of vision following reduction of the oxygen content of the air.** Arch. f. Augenh., 1933, v. 107, May, p. 216.

With reduction of the oxygen concentration the authors could regularly obtain a cut in the field of vision nasally and above, accompanied by enlargement of the blind spot. The smaller the amount of oxygen, the greater was the field defect. After breathing air in which

the oxygen had been greatly reduced, reduction in vision followed in a few minutes over the entire field. Following this immediately by breathing pure oxygen, there was an initial greater loss followed by "dazzling" brightness of vision. Frederick C. Cordes.

Holmes, Gordon. **Partial iridoplegia associated with symptoms of other disease of the nervous system.** Trans. Ophth. Soc. United Kingdom, 1931, v. 51, pp. 209-224.

Fifty-four cases of partial paralysis of the pupil of unknown etiology form the basis of this report. In nineteen of these there were other signs of nervous disease, such as loss of tendon reflexes. All nineteen were in women, and fourteen of them under thirty years of age. In four both eyes were involved, in three of these first one eye and later the other. The pupil was usually moderately dilated but varied in size and at times was quite small. It did not react at all to the strongest light. The reaction to convergence was usually sluggish, but it might be quite complete on prolonged convergence; at times it became pinpoint, and it also relaxed slowly. In most of the nineteen cases accommodation was not markedly altered. Atropin and eserin caused normal reactions. In all nineteen cases the knee jerks and ankle jerks were absent or diminished, but there was no change in the superficial reflexes, such as corneal or abdominal. No change was present in any form of sensation.

The author thinks this phenomenon due to an infection which involves several parts of the nervous system.

Thomas D. Allen.

Kronfeld, P. C. **The temporal half-moon.** Trans. Amer. Ophth. Soc., 1932, v. 30, pp. 431-456.

The writer discusses the physiology of the temporal crescent, lesions of the chiasm or optic tracts, and the suprageniculate pathway. Lesions of the visual radiations which produce first an isolated loss of the temporal half-moon, and then extend into the paired portion of the visual fields in the horizontal meridian, encroach upon the radiation from the convex surface of the brain. Where there is a loss of the temporal crescent he attempts to differentiate between hemiamblyopia and partial hemianopia. He also classifies cortical lesions based upon sparing or loss of the temporal halfmoon and includes a list of such cases. C. Allen Dickey.

Rutherford, C. W. **Central visual field studies in intracranial lesions.** Trans. Amer. Ophth. Soc., 1932, v. 30, pp. 359-373.

The sixteen cases include tumors of the frontal, temporal, and parietal regions and of the cerebellopontine angle. Study of the central visual fields supplies more information in patients with intracranial lesions accompanied by increased intracranial pressure than any other diagnostic procedure.

C. Allen Dickey.

Scala, N. P., and Spiegel, E. A. **Effect of stimulation of posterior longitudinal fasciculus on ocular muscles.** Arch. of Ophth., 1933, v. 9, June, pp. 939-946.

Attempts were made to stimulate the posterior longitudinal fasciculus in a granular part of the pons by unipolar faradic stimulation. Movements of the eyes occurred both horizontal and vertical; also dissociated movements horizontal of the opposite and vertical of the homolateral eye. These experiments seem to give support to the previously held opinion that the posterior longitudinal fasciculus carries ascending impulses to the crossed internal rectus muscle. M. H. Post.

Sinclair, A. H. H., and Dott, N. M. **A case of brain tumor illustrating the value and a possible fallacy of ophthalmoscopy.** Trans. Ophth. Soc. United Kingdom, 1931, v. 51, pp. 246-257.

For a year a twenty-six-year-old girl had had occasional epileptic seizures. Because of suddenly developing diplopia her eyes were examined and a papilledema was found. Meningioma was found by x-ray study and in association with symptoms of Jacksonian epilepsy. The tumor was completely removed and the patient cured.

Thomas D. Allen.

Sinclair, A. H. H., and Dott, N. M. **Hydrocephalus simulating tumor in the production of chiasmal and other parahypophyseal lesions.** Trans. Ophth. Soc. United Kingdom, 1931, v. 51, pp. 232-246.

Of several interesting pictures, one shows the pressure effect of a dilated third ventricle due to cerebellar tumor. The chiasm was stretched out and the hypophysis compressed. Clinically there was optic atrophy with hypopituitarism. In a case of internal hydrocephalus following subacute meningitis, headache, vomiting, unsteady gait, paresthesia, amenorrhea, optic atrophy with a tendency to bitemporal hemianopia, and optic nerve edema were the main symptoms. On exploratory operation only a dilated third ventricle was found. This was drained into the subarachnoid space, and the patient improved greatly. Thomas D. Allen.

Weekers, L., and Hubin, R. **Double hemianopsia with integrity of central vision.** Bull. Soc. Belge d'Opht., 1933. no. 66, p. 46.

In two cases observed, right homonymous hemianopsia existed when the patients first presented themselves at the clinic and the left hemianopsia which completely destroyed peripheral vision did not occur until from nine months to one year later. Some autopsies performed on subjects of double hemianopsia with conservation of central vision have shown, in the midst of extensive destruction of the regions bordering on the calcarine, relative integrity of the cerebral islets at the posterior extremity of the calcarine fissure. (Eight figures, bibliography.) J. B. Thomas.

13. EYEBALL AND ORBIT

Bender, Alexander. **Palpebro-orbital cyst with apparent anophthalmos.** Zeit. f. Augenh., 1933, v. 81, July, p. 55.

A child of fifteen months had anophthalmos with a cyst in the upper lid. Microscopic study revealed a cyst associated with a rudimentary eyeball. The lining of the cyst was inverted retina. A scleral anlage and a slightly developed optic nerve were found, also cell groups which were undoubtedly rudimentary choroid and retina, and some lens fragments. Cornea, vitreous, and other ocular structures could not be found. F. Herbert Haessler.

Guibor, G. P. **Simple evisceration of the globe versus simple enucleation.** Arch. of Ophth., 1933, v. 10, July, pp. 63-69.

Simple evisceration is easier than simple enucleation, results in a better cosmetic result, and there is less atrophy. In the opinion of the author the contention that sympathetic ophthalmia is more likely to follow evisceration than enucleation is not substantiated. M. H. Post.

Herrnheiser, G. **Possible diagnostic aids and the limitations of x-ray examination of the bones of the orbit.** Arch. f. Augenh., 1933, v. 107, May, pp. 53-115.

This is an excellent critical review. It discusses hyperostosis, otosclerosis, new growths, destructive processes, and traumatic changes, as well as changes in the region of the orbit due to pathology of the sinuses or other changes in surrounding areas. (Many excellent illustrations.) Frederick C. Cordes.

Krause, A. C. **Nature of the melanin of the eye.** Arch. of Ophth., 1933, v. 10, July, pp. 42-50.

This paper deals with the chemical analysis of melanin, particularly as formed in the eye. The author believes it a series of compounds varying in composition according to their mode of formation, the general basis being the action of tyrosinase or similar oxidizing enzymes on hydroxyphenol or like compounds. M. H. Post.

Leahey, G. A. **Orbital actinomycosis.** Trans. Amer. Ophth. Soc., 1932, v. 30, pp. 457-503.

A man aged fifty-four years had severe neuralgia of the right temple and upper jaw. There was also an indefinite edema at the inner part of the lower lid. Removal of the teeth resulted in a severe reaction with prostration. Exophthalmos gradually increased, with marked chemosis of the conjunctiva. Fluctuation was found down and

out through the lids and a half-dram of bloody fluid was aspirated. A similar abscess developed under the orbital periosteum. Cerebral symptoms gradually developed. Aspiration of a frontal lobe abscess revealed granules of actinomycosis. Autopsy revealed necrosis of the sphenoid. (Reviews of literature.) C. Allen Dickey.

Redway, L. D. **The antiquity of the forms of the transparent media of the eye. 2. Modifications of the light train.** Arch. of Ophth., 1933, v. 10, July, pp. 91-95.

The author refers to the lids, the iris, and the ciliary body as the three structures which influence the light train. He seeks to determine which one of these three is earliest in point of development, after which a similar discussion is entered into with regard to the recti. M. H. Post.

Russo-Frattasi, G. **The pathogenesis and clinical relations of chronic polysinusitis with orbital complications.** Annal. di Ottal., 1933, v. 61, March, p. 187.

Polysinusitis in which the orbital structures are involved is frequently a latent form of ethmoiditis, resulting from congenital or acquired defects of the septum or of the turbinates. (Cases, bibliography.) Park Lewis.

14. EYELIDS AND LACRIMAL APPARATUS

Blaskovics, L. **Lid operation to protect the cornea in exophthalmos and facial paralysis.** Zeit. f. Augenh., 1933, v. 81, July, p. 13.

To correct paralytic entropion the author excises a rhombohedral piece from the full thickness of the lid and a very long triangle of skin from the side of the nose. An incision parallel to the edge of the lower is made from one to the other. The intervening skin is undermined, and the edges are brought together with sutures. Diagrams make the procedure very clear.

To produce narrowing of the lidslit he performs tenotomy of the levator muscle and brings about a ptosis of 3.5 to 6 mm. In three out of four patients the result was entirely satisfactory. The procedure is particularly recommended in hyperthyroid exophthalmos. When the exophthalmos heals, the ptosis may be obviated by replacing the levator.
F. Herbert Haessler.

Bracci-Torsi, H. **Dacryocystitis and pneumococci.** Annal. di Ottal., 1933, v. 61, Jan., p. 29.

A study of the microbic flora of the conjunctiva in dacryocystitis showed almost constantly the pneumococci of the various types in the following order of frequency, type 4, type 1, type 2, and type 3. About forty days after removal of the sac, the pneumococci had in almost every instance disappeared from the lacrimal secretions. (Bibliography.)
Park Lewis.

Busacca, A. **Acute dacryadenitis.** Rassegna Ital. d'Ottal., 1933, v. 2, March-April, p. 226.

Busacca observed three cases of acute dacryadenitis in young patients among 30,000 eye cases. In the first case the infection was unilateral, of unknown origin, and accompanied by slight tenonitis and orbital periostitis. The course was subacute and upon x-ray treatment recovery occurred. In the second case the affection was bilateral and originated in a suppurative otitis media with pyemia. The bacterium coli was found in the blood, gland, and eye. A secondary pneumococcus infection also appeared. In the third case the adenitis was bilateral and followed tonsillitis. Staphylococcus aureus traveled through the middle ear to the ethmoid cells, to the cavernous sinus, orbit, and lacrimal gland. The second and third cases ended in cavernous sinus thrombosis and death. (Eight illustrations.)
Eugene M. Blake.

Cosmettatos, G.-F. **The pathogenesis of congenital fistulas of the lacrimal sac.** Ann. d'Ocul., 1933, v. 170, July, pp. 594-599.

In an eleven-year-old child, tears passed through a small skin opening below the inner canthus. There had never been signs of inflammation. The tract was excised down to the sac. The author distinguishes between inflammatory fistulas and the congenital type.

The specimen reported shows a morphological arrangement suggestive of supernumerary canaliculus. The type of epithelium found is not always the same, hence there is disagreement as to the pathogenesis.

H. Rommel Hildreth.

Jaensch, P. A. **Malignant tumors with the appearance of chalazia; epitheliomata and sarcomata of the lids.** Klin. M. f. Augenh., 1933, v. 90, May, p. 598. (Ill.)

Three cases are reported in detail as showing the importance of histological examination of suspicious cases and also as showing the superiority of extirpation of chalazia over curettement.

C. Zimmermann.

Kreiker, A. **A rare anomaly of lash formation in the lower retrotarsal fold.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 193. (Illustrations.)

A man aged twenty-nine years complained of a feeling as of a foreign body in the right eye. In the lower retrotarsal fold a lash at a right angle with the lid border had grown into the conjunctiva. It was excised with a fold of conjunctiva. Microscopically it showed normal development. The possible etiology is discussed. C. Zimmermann.

Marchesini, E. **Partial trichiasis, electrolysis of deviating cilia, and electrolytic sensibility.** Arch. di Ottal., 1933, v. 40, March, pp. 114.

The author uses a current of five milliamperes for from ten to twenty seconds. The electrolytic action is demonstrated by the formation of small gaseous bubbles around the needle. Not rarely after the first treatment a patient refuses repetition because of pain produced by the electrolysis, in spite of the anesthetic. The author's experiments did not offer sufficient explanation for this pain. Herman D. Scarney.

Márquez, M. **Esthetic treatment of the mild forms of blepharoptosis.** Arch. de Oft. Hisp.-Amer., 1933, v. 33, June, p. 363.

Where surgical intervention would be too radical or adventurous for the mild degree of ptosis, whether congenital, due to neglected lues, or to chronic inflammatory conjunctival disease, especially trachoma, or as a manifestation of the Bernard-Horner syndrome, the instillation of cocaine and adrenalin, combined with pilocarpin when necessary to prevent mydriasis, produces the desired cosmetic effect. If used long enough, particularly in cases of blepharospasm in chronic conjunctivitis, the result may become permanent by breaking up the vicious circle.

M. Davidson.

Musial, Albin. **Amyloid tumor of the lid.** Zeit. f. Augenh., 1933, v. 80, May, p. 250.

In a fifty-year-old woman the left upper lid had become greatly enlarged in the course of one and one-half years. Excision of the tumor mass revealed extensive amyloidosis with some hyalin degeneration. The disease is rare, and is not necessarily associated with trachoma or general amyloidosis. Treatment is surgical and it is only necessary to remove a large part of the mass, the remainder undergoing atrophy. F. Herbert Haessler.

Puscariu and Lazarescu. **Mikulicz' disease.** Annal. di Ottal., 1933, v. 61, March, p. 161.

A distinction is made between Mikulicz' disease and the syndrome of the same name. In the former there is indolent tumefaction of the lacrimal and salivary glands. In the syndrome there are also general symptoms including lymphatic or myologenous leukemia, tuberculosis, syphilis, lymphosarcoma, and Hodgkin's disease or uveoparotidean fever. The syndrome is much more readily influenced by roentgen radiations. Three cases are described, with one plate and bibliography.

Park Lewis.

Rötth, A. **Importance of verruca of the lid border in the etiology of certain inflammations of conjunctiva and cornea.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 196.

In two patients conjunctivitis and in three others keratitis in connection with

wart on the lid border were observed. The inflammation healed in a few days after removal of the warts. One patient refused removal and the affection persisted during the whole time of observation. C. Zimmermann.

Russo-Frattasi, G. **Dacryocystorhinostomy or dacryocystectomy in ozena.** Ann. di Ottal., 1933, v. 61, Feb., p. 124.

The dangers of further infection of the sac from the Toti-West operation or that of Depuy-Dutemps are considered and the difficulty of maintaining an aseptic area for introduction of a suture is discussed. This is avoided by the total ablation of the sac here described. (Bibliography.) Park Lewis.

Sanyal, Saradindu. **Fungus infection of the eye.** Calcutta Med. Jour., 1932, v. 27, Dec., p. 163.

The lids of one eye of a fifteen-year-old Hindu girl had been tensely swollen for about a year, without sharp inflammation. On everting the lids under anesthesia, each fornix was found to contain a reddish-yellow friable mass. Laboratory culture showed streptothrix. Iodine was applied to the lids and the patient recovered within a few weeks. Ralph W. Danielson.

Spinelli, F. **Diathermic recanalization of the nasolacrimal canal.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 202. (Illustrations.)

This operation consists in coagulation of the membranous nasolacrimal canal, the final result being permeability of the physiologic tear-conducting passages. C. Zimmermann.

15. TUMORS

Annen, Eugène. **Sarcoma of the choroid.** Ann. d'Ocul., 1933, v. 170, Aug., pp. 651-662.

Twelve case reports are illustrated by colored drawings. The study is based on the macroscopic appearance of bisected eyes. The tumors fall into three groups; pure melanosarcoma, leucosarcoma, and a mixed type. The mixed form is most commonly seen, but the amount of pigment does not seem to be indicative of the degree of malignancy. Spreading of the growths from the globe takes place along emissary veins, never directly through the sclera. Size of retinal detachment seen before enucleation does not give conclusive evidence of size of tumor.

H. Rommel Hildreth.

Argañaraz, R., Courtis, B., and Adrogue, E. **Glioma of the retina.** Arch. de Oft. de Buenos Aires, 1932, v. 7, Aug., pp. 451-462.

This anatomic pathologic study of glioma of the retina is illustrated with microphotographs of several cases. The authors discuss the different theories as to the origin of the rosettes of Wintersteiner, and incline toward Urra's opinion of the glial nature of the tumor cells. R. Castroviejo.

Cosgrove, K. W. **Carcinoma of the bulbar conjunctiva.** Southern Med. Jour., 1933, v. 26, April, p. 326

The author discusses differential diagnosis. Two case reports are given, with twenty references and ample discussion. Ralph W. Danielson.

DeLong, Perce. **Metastatic carcinoma of the choroid.** Amer. Jour. Ophth., 1933, v. 16, Aug., p. 712.

Finkelman, I., and Mayer, L. L. **Metastatic carcinoma of the eye and brain.** Arch. of Ophth., 1933, v. 10, July, pp. 83-90.

Since the first case in 1872, only 130 cases of carcinoma metastasizing in the eye have been reported. One additional case is herewith described. The psychosis also present was probably due to toxic encephalitis.

Huber, A., and Picela, J. P. **Primary papilliferous cystoadenoma of Moll's glands.** Arch. de Oft. de Buenos Aires, 1932, v. 7, Oct., pp. 579-597.

After detailed topographic, morphologic, and histologic study of the so-called glands of Moll, the authors report a case which by its location and histologic structure might be considered as of such a tumor. R. Castroviejo.

Lumbroso, U. **A fibrohemangioma of the caruncle.** Rassegna Ital. d'Ottal., 1933, v. 2, March-April, p. 198.

A fibrohemangioma arising from the caruncle in a twenty-eight-year-old man is described by Lumbroso. The growth was pedunculated and extended between the lids, bleeding easily. Its greatest diameter, the anterior-posterior, measured 1.5 cm. The presence among the connective tissue cells of an amorphous substance, having all the appearances of mucin, led to the diagnosis of a fibrohemangioma myxomatosa. Only one other case is described in the literature. (Five illustrations.)

Eugene Blake.

Michail, D. **Cystic and lymphatic angioma of the orbit.** Ann. d'Ocul., 1933, v. 170, Aug., pp. 641-651.

The tumor was removed from a six-year-old girl. At birth a small swelling was seen at the inner canthus; for three weeks before operation the mass had enlarged considerably, displacing the eye down and out. The eye was hyperopic 1.50 D. with vision of fifty percent. In a similar case the eye was microphthalmic, so the author feels that such a congenital tumor interferes with normal development of the eye. The nasal part of the tumor was largely lymphatic. Deep in the mass was found a large cystic blood cavity, aneurismal in type, which was thought to be of recent development and would explain the sudden increase in size.

H. Rommel Hildreth.

Musial, Albin. **A case of malignant lymphogranuloma of the semilunar fold of the eye.** Zeit. f. Augenh., 1933, v. 81, July, p. 63.

The clinical course, blood picture and histologic picture strongly suggested that the masses removed from the right eye of a forty-eight-year-old male were malignant lymphogranuloma. The histologic diagnosis could not be made unequivocally, since the same picture is found in leukemia and pseudoleukemia. The author was unable to find a similar lesion reported in the entire literature since 1914.

F. Herbert Haessler.

Sala, G. **A case of diffuse papilloma of the conjunctival sac.** Rassegna Ital. d'Ottal., 1933, v. 2, March-April, p. 165.

The patient described by Sala was a man of seventy-five years, whose left eye had been irritated for six years. Four years previously an ulcerated carcinoma had been excised from the dorsum of the right hand. There was ptosis of the right upper lid, and a tumor mass the size of a large lentil on the upper part of the bulbar conjunctiva. The plica and caruncle were involved. The growth was not attached to the sclera. Histologically it was a simple papilloma. (Five illustrations.)

Eugene M. Blake.

Seña, J. A. **Malignant lacrimal-sac tumors.** Arch. de Oft. de Buenos Aires, 1932, v. 7, Oct., pp. 603-619.

One tumor was a cylindroma, a second a sarcoma. Neither of these clinic cases was followed up to complete the history. Finally the author reports a private case in which, six months after operation to remove a supposed mucocele, a tumor the size of an egg appeared, which after biopsy was diagnosed as an epithelioma. The tumor was treated by electrocoagulation followed by radium treatments, with no recurrence after eight months. A plastic operation was advised for cosmetic purposes.

R. Castroviejo.

Soria. **Radiotherapy of epibulbar tumors.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 112.

The author describes technique for treatment of epibulbar tumors. The tumor is first excised as completely as possible. A microscopic examination is made the same day, and if the neoplasm is found to be of epithelial origin radium is applied. This may be done with needles or tubes, fixation being obtained with conjunctival sutures. Four cases so treated have healed completely.

Phillips Thygeson.

Szekely, Josef. **A contribution to the genesis of epithelial lining of the interior of the eye (chamber cysts).** Graefe's Arch., 1933, v. 130, p. 52.

The author reviews the various mechanisms by which epithelial cysts are formed within the eye, including proliferation of surface epithelium along

the wound canal, and the rarer implantation of surface epithelium within the eye. Any transitional stage may be found from definite connection of the epithelium of the cyst with the surface from which it was derived to complete detachment from the surface epithelium. H. D. Lamb.

Van Duyse. **Basocellular epithelioma of the meibomian gland.** Bull. Soc. Belge d'Opht., 1933, no. 66, p. 18.

If chalazion seems to recur in the same location it is prudent not to neglect microscopic analysis. The author reports such a case in a woman aged forty-seven years. A large section of the lid had to be removed, and a plastic operation resorted to. The pathologic diagnosis was basocellular epithelioma. Basing on a statistical study by Morax, the author concludes that glandular epithelioma of the lids only occurs about once in 120,000 patients.

J. B. Thomas.

Vele, M. **Contribution to the study of kerato-conjunctival teratomata.** Lettura Oft., 1933, April, p. 184.

Two cases are described clinically and histologically, one situated at the external angle of the bulbar conjunctiva and the other at the corneoconjunctival margin. Inclusion of a tract of mesenchymal tissue by ectoderm is mentioned as the etiology in the first case. Corneoconjunctival dermoid is attributed to adhesion of the free margin of the lids to cornea and bulbar conjunctiva during the early weeks of fetal life, by reason of an obstacle to normal closure of the oblique fissure of the face.

F. M. Crage.

16. INJURIES

Biondo, M. D'A. **Lesions of the eye from coal tar products.** Rassegna Ital. d'Ottal., 1933. v. 2, March-April, p. 259.

This monograph of seventy-five pages describes the action upon animal eyes of some thirty coal-tar products. In general these chemicals produce inflammation of the skin varying from erythema to an eczematous stage. The conjunctiva reacts by a flow of mucous or fibromucous secretion and abrasions of tissue. In the cornea the process varies from minute abrasions to deeper erosion, followed by necrosis, deep vascularization and loss of corneal sensation. Histologic studies are recorded. (Five illustrations.)

Eugene M. Blake.

Busacca, A. **Anatomical and clinical considerations on hemorrhages between the posterior lens capsule and anterior hyaloid membrane, and on the formation of a retrolenticular space.** Klin. M. f. Augenh., 1933, v. 91, July, p. 58. (Ill.)

From three cases described, and from the literature, the author concludes that the retrolenticular space of Berger does not exist as a previous formation but appears under abnormal conditions. In trauma the adhesion between the lens capsule and the anterior hyaloid membrane may be interrupted by sudden displacement of the lens into the patellar fossa. If there is simultaneous hemorrhage the blood by its weight and capillary action may gradually separate the laminas. These thin hemorrhages assume the shape of a crescent with its convexity downward. They are finally absorbed. C. Zimmermann.

Goodhart, S. P., and Savitsky, N. **Self-mutilation in chronic encephalitis. Avulsion of both eyeballs and extraction of teeth.** Amer. Jour. Med. Sciences, 1933, v. 185, May, p. 674.

The authors report the case of a young woman with chronic encephalitis, who avulsed both eyes with her fingers. An interesting feature was that the eyes appeared as if surgically removed except for the fact that one nerve was two inches long and the other one inch. There was apparently but little pain attendant upon the mutilation. A review of the literature and a psychiatric discussion are given. (Fifty references.)

Ralph W. Danielson.

MacRae, Alexander. **A case of "hole" at the macula.** Trans. Ophth. Soc. United Kingdom, 1931, v. 51, pp. 139-152.

A girl of nineteen years was struck in the eye by the cork of a beer bottle. When seen thirty minutes later, blood was coming through the pupil and vision equalled light-perception. A month

later the vision was 6/18. In another month the retinal hemorrhages had cleared and a slightly elevated ring around a tiny white spot at the macula was seen for the first time. Metamorphopsia was present, and a scotoma which increased with the size of the macular lesion, until in eleven months it became evident that a hole had developed. Parallactic displacement was present. Thomas D. Allen.

Maggiore, L. **Contribution on retinal changes from experimental exposure of the human eye to intense light.** Annal. di Ottal., 1933, v. 61, Feb., p. 81.

Before enucleation three normal human eyes which had to be removed because of malignant orbital tumors were exposed, the first to the full rays of the sun for ten minutes, the second and the third (apparently for a like interval) to the direct light of a Zeiss Hammer lamp. Microscopically all three eyes showed adhesions between the layer of rods and cones and the pigment cells, edema especially of the plexiform layer with hyperemia of the retinal vessels, and edema and hyperemia of the choroid. The rods and cones in the vicinity of the macula showed degenerative changes, and the papilla indicated inflammatory reaction. (One plate.) These findings were confirmed by experiments on dogs. Park Lewis.

Michail, D. **Concussion cataract.** Graefe's Arch., 1933, v. 130, p. 84.

Two cases are reported. A forty-year-old man received a severe contusion in the left occipital region. Three days later the vision of the right eye was reduced to counting fingers at 10 cm. and that of the left eye to 2/50. The visual field of the left eye was contracted to 10°. The slitlamp showed in the right eye a dense equatorial, superotemporal subcapsular lens opacity with fine opacities in the posterior cortex and upon the entire surface of the senile nucleus. The lens of the left eye was unchanged. On the third day after the accident there was severe veiling of the right fundus and edema of the nasal half of the left papilla. By the tenth day the fields regained their normal limits, the vision of the right eye improved to fifty percent of normal, that of the left eye to normal, the opacities in the lens of the right eye were considerably diminished, and the papilledema in both eyes had practically disappeared. After two years and three months the vision of the right eye was 1/40 and that of the left eye 5/7. The field for the right eye was concentrically contracted to 10°, that for the left eye was normal. The opacities in the right lens had increased so as to resemble zonular cataract. In the left eye were noted for the first time lens opacities in the inferotemporal quadrant of the posterior surface of the senile nucleus.

The other patient examined was a forty-seven-year-old man in whom pronounced diminution of vision of the left eye immediately followed a violent blow on the head in the left parietal region. The vision of the right eye was normal, that of the left eye fifty percent. Both fields were normal. Slitlamp examination showed a dense opacity of the left lens in its lower equatorial region, and extending as a stellate opacity around the posterior pole. There was also a fine irregular ellipsoid opacity in the cortex near the anterior pole. Neither fundus showed any change.

H. D. Lamb.

Proust, R. **Traumatic keratitis and transitory hypopyon.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 140.

This type of transitory hypopyon follows corneal trauma, often minimal. The clinical picture at first is usually as follows: minute ulceration staining feebly with fluorescein, moderate circumscribed infiltration, hypopyon varying in amount up to one or two millimeters in depth, moderate inflammatory reaction, and normal conjunctiva and lacrimal passages. Bacteriological examination is negative. The hypopyon often disappears in forty-eight hours or less. The cornea becomes cicatrized in from eight to ten days, three weeks at the most. Subconjunctival injection of cyanide of mercury is very effective in these cases; it is never necessary to use the actual cautery.

Phillips Thygeson.

Roese, H. F. **Injuries of the orbital contents by endonasal operation on the ethmoidal sinuses.** Klin. M. f. Augenh., 1933, v. 91, July, p. 95 (Ill.)

Two cases are reported in which the lamina papyracea was perforated in cleaning out the ethmoidal sinuses with resultant paralysis of the third nerve and divergent strabismus. In the second case the eye was blind from laceration of the optic nerve. Enophthalmos was likely due to hernia of retrobulbar tissue into the opened sinus. The first branch of the fifth nerve was also injured.

C. Zimmermann.

Sallmann, L. **Retinal injury from hypochlorites and homologous halogen salts.** Zeit. f. Augenh., 1933, v. 80, June, p. 342.

In the past six years severe ocular disturbances have been reported after therapeutic use of concentrated Pregl's iodine solution. In the rabbit neither sodium iodide nor free iodine causes any changes in the neuroepithelium which are visible ophthalmoscopically or histologically. Sodium hypoiodite (NaIO) however, constantly causes acute destruction of the pigment epithelium. The homologous compounds of chlorine and bromine produce similar effects. F. Herbert Haessler.

Satanowsky, P. **Avulsion of optic nerve at scleral opening by traumatism over superior orbital margin and root of nose.** Arch. de Oft. de Buenos Aires, 1932, v. 7, Nov., pp. 643-651.

After review of thirty similar cases in the literature the author reports a case in which the fundus of one eye showed peculiar lesions corresponding to avulsion of the optic nerve at the scleral opening. At the site of the disc was a circular slate-colored space of the same size as the disc, surrounded by hemorrhages. X-ray showed fracture of the nasal bones and orbital margin, but no lesion of the optic foramen. The mechanism is explained by contrecoup.

R. Castroviejo.

Shoji, Y., and Tanabe, H. **The problem of hemorrhage in the cornea and brilliant corpuscles.** Ann. d'Ocul., 1933, v. 170, July, pp. 589-594.

Two injury cases are reported with microscopic findings. The first showed blood staining of the cornea clinically but no corpuscles, while in the second case, although there was blood in the anterior chamber and microscopic section did show the corpuscles, there was no clinical bloodstaining of the cornea. The second observation is added as a fifth type to the generally recognized four types of hemorrhagic cornea, namely: (1) the presence of brilliant corpuscles and pigment granules; (2) the presence of brilliant corpuscles without pigment granules; (3) the presence of pigment granules without brilliant corpuscles; (4) absence of both brilliant corpuscles and pigment granules. H. Rommel Hildreth.

Van Manen, J. G. **Ocular damage due to so-called scare pistols.** Arch. f. Augenh., 1933, v. 107, May, p. 251.

Two cases of ocular damage resulted from shots from pistols used to frighten intruders. These firearms discharge a cartridge of specially mixed powder to which, as a rule, a gas cartridge has been added. Frederick C. Cordes.

Yanes, T. R. **A Claude Bernard-Horner syndrome and infantile cerebral hemiplegia due to birth injury.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, May-June, p. 181.

A forceps-delivered child presented, in addition to left hemiplegia and left facial paresis, the following findings in the left eye: narrow palpebral fissure, miosis which did not react to cocaine, convergent strabismus, enophthalmos, lighter color of iris, and vision of 20/20. The eye symptoms are attributed to hematomyelia of the medulla rather than to a peripheral sympathetic lesion, because of the absence of secretory and vasomotor sympathetic involvement.

M. Davidson.

17. SYSTEMIC DISEASES AND PARASITES

Ferrer, H. **Sulphonate of guayacol and calcium in treatment of ocular tuberculosis.** Anal. Soc. Mexicana de Oft. y Oto-Rino-Laring., 1932, July-Dec., p. 167. (See Amer. Jour. Ophth., 1932, v. 15, Dec., p. 1191.)

Heine, L. **On the possibility of successful treatment of tuberculosis of the eye and brain stem.** Zeit. f. Augenh., 1933, May, v. 80, p. 209.

With extracts from clinical records of thirteen patients, the author emphasizes the fact that a clinical diagnosis of tuberculosis may be made with a fair degree of certainty in iritis nodosa, disseminated choroiditis, and solitary tubercle of the retina and choroid. Tuberculosis is the most common cause of symptoms pointing to a lesion in the pons—sixth nerve paralysis, conjugate paralyses, combined sixth and seventh nerve paralysis, and third nerve paralysis particularly combined with hemicranial symptoms. In 178 lesions in the pons collected by Uhthoff, tuberculosis was the most frequent cause.

F. Herbert Haessler.

Janson, E. **Observations on leprosy of the eye in Latvia.** Klin. M. f. Augenh., 1933, v. 91, Aug., p. 213.

In the leprosariums of Riga and Talsen, from 1926 to 1932, Janson observed 235 leprosy patients. He concludes that infection of the eye by leprosy travels from without inward. The anterior segment is involved, while affections of the fundus are rare. Intravenous injections of chrysolgan had no visible effect on the course of ocular leprosy. In practical blindness due to keratitis progressing from the periphery, an optical iridectomy behind the remaining transparent sector of the cornea gives a good although frequently transient result.

C. Zimmermann.

Kubik, J. **Eye changes in lymphatic leukemia.** Arch. f. Augenh., 1933, v. 107, May, pp. 142-152.

Kubik reports post-mortem findings in the eyes of a patient with lymphatic leukemia. The changes were primarily in the choroid, which was definitely thickened. The veins were enlarged but without changes in their walls. The arteries seemed to be empty or to contain little blood. Here and there were areas of round-cell infiltration which, however, did not resemble lymphomas.

Frederick C. Cordes.

Lourie, O. R. **What is wrong with the application of the theory of focal infection?** Arch. of Ophth., 1933, v. 9, June, pp. 918-924.

This paper is the third of a series written in protest against wholesale application of the theory of focal infection. The author concludes that neither the present state of scientific knowledge nor clinical observations warrant the promiscuous performance of operations for removal of so-called foci of infection in the treatment of ocular or other diseases.

M. H. Post.

Ormond, A. W. **Notes on the ocular symptoms found in osteitis deformans (Paget's disease).** Trans. Ophth. Soc. United Kingdom, 1931, v. 51, pp. 258-265.

The author assembles opinions to explain the findings in the case which he reports. With general vascular degeneration, thrombosis, congestion, hemorrhages, and varicosities found in bone and other tissues, one would expect such changes in the retina, choroid, ciliary body, and optic nerve. Hormonic defect of the parathyroid gland and late congenital lues are discussed as etiologic factors.

Thomas D. Allen.

Schmelzer, Hans. **Ocular complications of vaccination and their prevention.** Zeit. f. Augenh., 1933, v. 80, June, p. 356.

The author observed four cases of ocular vaccinola among one thousand patients in the eye clinic. In two of them the child infected its own eyes and in two the virus was introduced into the eye from the fresh vaccination of a sibling. Usually the intermarginal area of the lid is the site of a lesion which spreads to the conjunctiva and the skin. The cornea is rarely involved and then usually in the form of a deep-seated disciform opacity which arises after the conjunctival lesion has begun to clear and always leaves an opacity which reduces visual acuity. Pyogenous ulcer, with perforation and destruction of the eyeball, is extremely rare. A protective dressing would reduce such complications to a minimum.

F. Herbert Haessler.

Tristaino, L. **Ocular phenomena consecutive to heating and cooling of the superior cervical ganglion.** Arch. di Ottal., 1933, v. 40, Feb., pp. 49-96, and March, pp. 97-113.

The author describes his apparatus. He used a temperature between 37 and 70 degrees Centigrade. The cat was used in all experiments because its ganglion is larger and more easily isolated. A temperature between 39 and 65 degrees Centigrade caused hyperemia and redness of the corresponding ear, hyperemia of the conjunctiva with mucous secretion following, diminution of corneal sensitivity, paralysis of the nictitating membrane, narrowing of the palpebral fissure, and miosis. The higher the temperature the more intense and prolonged the manifestations. The paralysis of the third lid produced by heating the ganglion at 39 degrees lasts four days, and at 65 degrees lasts 22 days. The palpebral fissure returns to normal in five days when heated to 39 degrees, and in 20 to 21 days if at 65 degrees. If the ganglion is heated to 39 degrees miosis lasts six days, if at 42 degrees miosis lasts eleven days, if at 60 degrees it lasts eighteen days, and if at 65 degrees it lasts twenty-four days.

Using a temperature of 55 degrees the pupil of the atropinized eye corresponding to the side of the ganglion treated with heat contracts about 1.5 mm. Heating of the ganglion after instilling eserin in the eye corresponding to the ganglion brings about marked accentuation of miosis. Heating of the ganglion produced in the corresponding eye a great increase in the albuminoid content of the aqueous humor; but no variation in the albuminoid content of the other eye.

The ocular phenomena obtained by the action of cold on the superior cervical ganglion were identical with those following heating of the ganglion. The histological appearances of the ganglia are described and are illustrated with microphotographs. H. D. Scarney.

Vele, M. **The glutathione content in ophthalmias.** Annal. di Ottal., 1933, v. 61, March, p. 170.

Comparing the blood of 180 patients having various ophthalmic diseases, and control tests on fifty persons in normal health, in the blood of the ophthalmic patients the glutathione percentage was higher than normal. This increase was more generally obtained in those having corneal disturbances, and in them there was also an increased number of red corpuscles. (Bibliography.)

Park Lewis.

Vele, M. **Study of ocular lesions in acquired syphilis.** Rassegna Ital. d'Ottal., 1933, v. 2, March-April, p. 177.

Vele removed the chronically inflamed eye of a sixty-four-year-old woman who was actively syphilitic. All the membranes of the eye were affected but more particularly the uveal tract. In addition there were calcareous degeneration of the lens, bony degeneration of the choroid, and partial detachment of the ciliary body. Microscopic findings of the different layers are given, and a review of the literature. (Twenty illustrations.)

Eugene M. Blake.

Wulkow, F. **Dental infections and the eye.** Zeit. f. Augenh., 1933, v. 80, May, p. 243.

In twenty-two cases of acute and chronic iritis, iridocyclitis, blepharitis, episcleritis, and choroiditis the lesion healed immediately and strikingly after root treatment, or extraction or filling of an infected tooth. The diagnosis can only be made with a degree of probability and by exclusion.

F. Herbert Haessler.

Zanettin, G. **Elective localization of the staphylococcus in the eye.** Annal. di Ottal., 1933, v. 61, Jan., p. 20.

The researches of Rosenow show that organisms isolated from a focal infection and introduced experimentally in another animal will affect the corresponding organ. The author believes that this is not so much due to elective trophism of the germ as to a quality given it by the culture medium. He inoculated rabbits with staphylococcus aureus which had been cultivated in blood serum, and an equal number with the same organism cultivated in a like medium to which uveal tissue had been added. In the first group infections were

found in liver and spleen and only in a few instances in the eye. In the second group sixty-six percent showed eye infections. The author concludes that by passage through a medium containing uvea it is possible to confer oculotrophism on an organism previously lacking this quality. Park Lewis.

18. HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Cunha, Moacir. **Organization of medical work.** Arquivos do Instituto Penido Burnier (Brazil), 1933, v. 1, March, pp. 9-82.

This covers, quite elaborately, the keeping of office records by the file system; and the classification of studies in the literature and of library resources (including an alphabetical indexing of the whole field of ophthalmology).
W. H. Crisp.

Gordon, B. L. **Ophthalmology in the Bible and in the Talmud.** Arch. of Ophth., 1933, v. 9, May, pp. 751-788.

The writer calls attention to numerous references to diseases of the eye in Bible and Talmud and recommendations made by the ancients for treatment. M. H. Post.

Graham, C. W. **Certification of blindness.** Trans. Ophth. Soc. United Kingdom, 1932, v. 52, pp. 293-297.

This paper is reviewed together with that of John Marshall and Charles M. Smith. Thomas D. Allen.

Griscom, J. M. **The new Wills Hospital.** Arch. of Ophth., 1933, v. 9, June, pp. 915-917.

This brief address was read at the opening, November 12, 1932, of a new hospital building on the one hundredth anniversary of the founding of the original one. During these one hundred years, more than 800,000 patients have been cared for. Since 1839, 156 resident surgeons have received training.
M. H. Post

Hoffman, W. F. **Medical economics.** Amer. Jour. Ophth., 1933, v. 16, Aug., p. 716; and Trans. Pacific Coast Oto-Ophth. Soc., 1932, 20th annual meeting, p. 11.

Marshall, J., and Smith, C. M. **Blindness and its certification.** Trans. Ophth. Soc. United Kingdom, 1932, v. 52, pp. 282-293.

This paper and the one by Graham on certification of blindness in the same transactions bring out several interesting points. (1) It is recommended that all applicants for blind pension be examined by ophthalmic surgeons, and that a uniform basis for investigating causes be instituted; (2) There should be a uniform standard of blindness. The Blind Pensions Act of 1920 defines blindness as "so blind as to be unable to perform any work for which eyesight is essential." The Committee of the Royal Society of Medicine reported that in their opinion visual acuity below 3/60 constituted blindness and occasionally vision below 6/60, depending upon intelligence, bodily strength, and the nature of the blindness. (3) The value of sightsaving classes is emphasized. (4) Refusal to undergo operative treatment does not disqualify for blind pension; (5) In the investigations many persons were found on blind pension who should not have been; and many applied who were refused pension after scientific examination. Thomas D. Allen.

Parisotti, O. **The French Ophthalmological Society during the past fifty years.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 21.

The contributions to science by members of the French society during the last fifty years are reviewed.
Phillips Thygeson.

Passos, Toledo. **Necessity for remodeling our law as to industrial accidents as relates to ocular accidents.** Rev. de Ophth. de São Paulo (Brazil), 1933, v. 2, June, pp. 243-251.

The author would vary compensation according to occupation, dividing occupations into three classes: (1) occupations which require best vision; (2) those which can be practiced with moderate vision; (3) those which can be carried on with poor vision. After the age of forty years he would give a five percent greater indemnity. He appends a table of compensations for the differ-

ent classes, varying from fifty percent on the basis of visual acuity of one-twentieth or less to five percent for visual acuity of two-thirds in the first class, or five percent on the basis of visual acuity of one-half in the third class.

W. H. Crisp.

Simonin, C. **Experimental investigations concerning the minimum visual acuity of automobile drivers.** Arch. d'Opht., 1933, v. 50, July, p. 480.

An automobile traveling eighty kilometers an hour requires a distance of thirty-five meters to be safely stopped. An image the size of a child of six years, colored dark on one side and light on the other, was used as a test of visual acuity at this distance under varying conditions of illumination. Normal individuals made myopic by lenses gave very inconsistent results. By testing the visual acuity of individuals when they were just able to see clearly the image of the child at the required distance it was found that the minimum vision necessary was 0.1 and it was frequently necessary to have an acuity of 0.25 or 0.33 to pass the test, while some astigmatic individuals required correction to 0.5. In order to provide a margin of safety the writer concludes that for nonprofessional drivers of automobiles a visual acuity of 0.33 should be required. On account of the danger of objects approaching from the blind side one-eyed individuals are not safe automobile drivers. A visual acuity of 0.1 should be required in the poorer eye as this is the minimum which permits satisfactory recognition of approach of objects from the side. A table of the visual requirements for automobile drivers now in effect in several European countries accompanies the article.

M. F. Weymann.

Terson, A. **Some French teachers of other days.** Bull. et Mém. Soc. Franç. d'Ophtalmologie, 1932, p. 37.

NEWS ITEMS

News items in this issue were received from Drs. William H. Crisp, Denver, R. O. Rychener, Memphis, F. M. Sulzman, Troy, N.Y., and F. L. Wicks, Valley City, N.D. News items should reach **Dr. Melville Black, 424 Metropolitan Building, Denver,** by the twelfth of the month.

Deaths

Dr. Montie C. Comer, Tucson, Ariz., aged forty-eight years, died, July 25.

Dr. Harvey Mayor Becker, Sunbury, Pa., aged sixty years, died, August 28.

Dr. Jeremiah Joseph Corbett, Boston, aged fifty-five years, died August 24.

Dr. Paul Caspers, Chicago, aged sixty-five years, died, August 25, of pneumonia.

Dr. Alfred Marvin Hall, Chicago, aged seventy-one years, died suddenly, August 27, of coronary thrombosis.

Dr. Maximilian Adolph Schurter, Long Beach, Calif., aged fifty-one years, died, August 22, of coronary sclerosis and pulmonary edema.

Societies

The thirty-eighth annual meeting of the American Academy of Ophthalmology and Otolaryngology was held in Boston, September 18-22, with a registration of 605. Newly elected officers are: Drs. Wells P. Eagleton, Newark, N.J., president elect; Leroy A. Schall, Boston, first vice-president; William F. Hardy, St. Louis, second vice-president; Frank J. Novak, Chicago, third vice-president; Secord H. Large, Cleveland, comptroller; William P. Wherry, Omaha, executive secretary-treasurer; W. L. Benedict, Rochester, Minn., secretary for ophthalmology; John L. Myers, Kansas City, Mo., secretary for otolaryngology; Harry S. Gradle, Chicago, secretary for postgraduate work in ophthalmology; William V. Mullin, Cleveland, secretary for postgraduate work in otolaryngology; Edward C. Ellett, Memphis, member of council; William H. Wilder, Chicago, member of the American Board of Ophthalmology (the new name of the American Board for Ophthalmic Examinations); Charles A. Bahn, New Orleans, member of the committee on optics and visual physiology. The convention city next year will be Chicago. The examination of the American Board of Otolaryngology was held on Saturday, September 16, and that of the American Board of Ophthalmology, on Tuesday, September 19. The St. Louis golf cup was won by Dr. William Chester Warren, Jr., of Atlanta, Ga. The weather during the meeting was cool but almost continuously free from rain.

The Academies of Ophthalmology and Otolaryngology of both Dakotas were guests of the Mayo Clinic at Rochester, Minn., September 29. Operative clinics and a tour of the buildings occupied the morning. The afternoon was devoted to addresses and discussions on topics of interest to specialists by members of the eye, ear, nose and throat staff and other members of the Clinic. Many cases were presented by these clinicians, most of the addresses having film or slide illustrations. A sumptuous dinner was served at the Kahler Hotel at six thirty o'clock, the meeting concluding with an evening session. Dr. Avery D. Prangen was in charge of arrangements.

Officers elected in the section of Ophthalmology and Otolaryngology at the last meeting of the New York State Medical Society, held in New York city, were: chairman, Dr. Frank M. Sulzman, Troy, New York, and secretary, Dr. Webb W. Weeks, New York.

Miscellaneous

Dr. Harry S. Gradle has recently been appointed Chief of Staff of the Illinois Charitable Eye and Ear Infirmary. The following attending ophthalmologists have been appointed: E. K. Findlay, D. C. Orcutt, T. D. Allen, L. G. Hoffman, R. Von Der Heydt, S. J. Meyer. Each attending surgeon has two associates, two adjuncts, one intern. There is one resident to each two services. There are fifteen extra-mural surgeons from Illinois outside of Chicago, on duty one day per month.

A special sight-saving class for children with seriously defective vision is maintained by the San Francisco Board of Educaton in the Jean Parker School in "Chinatown." Although the class is operated on the modern American principle of special educational facilities for physically handicapped children, all of the eleven pupils in this particular class are Chinese boys and girls. Miss Ursula L. Duane, an American, is in charge.

The children use books in large type, and as much of the work as possible is done on the blackboard to relieve eyestrain. Adjustable seats and desks are used: particular care is exercised in regard to the lighting arrangement in the classroom; and every child is taught the touch system on the typewriter as soon as possible so that the eyestrain of handwriting may be avoided.

These methods are also employed for approximately 6,000 children with seriously defective vision in the 420 other sightsaving classes throughout the country.

The promotion of Miss Eleanor P. Brown, secretary of the National Society for the Prevention of Blindness, to the rank of associate director, is announced by Lewis H. Carris, managing director of the Society. Miss Regina E. Schneider, formerly secretary to Mr.

Carris, becomes secretary of the organization.

Miss Brown, in addition to other work, will have administrative charge of the training, placement and supervision of medical social workers for service in eye clinics and hospitals. Mrs. Winifred Hathaway, who has been an associate director for some years, is director of the educational activities.

The appointment of Theodore O. Yoder as staff associate of the National Society for the Prevention of Blindness is announced by Lewis H. Carris, managing director.

Mr. Yoder was formerly on the staff of the American University at Cairo, Egypt. As part of his duties in the Division of Extension, he produced a three-reel motion picture film on the care of the eyes which is now being used in public health education campaigns in Egypt, India and Japan.

Mr. Yoder received his B.A. degree from Southern Methodist University, Dallas, Tex., and his M.A. degree from Columbia University, New York City.

The University of Buffalo Gold Medal is awarded annually to the author of an article on an ophthalmologic or allied subject. Details may be had by writing the Dean of the Medical Department.

Labor Day Week witnessed a gala celebration in Southbridge. It attracted the notice of Lowell Thomas who on his coast-to-coast radio broadcast of the daily news of September the sixth, said: "In a little town of Massachusetts they are celebrating a birthday today—the 100th anniversary of the making of 'specs.' Just 100 years ago the American Optical Company began the manufacture of eye-glasses at the quaint Massachusetts town of Southbridge. Everyone there is celebrating, with banquets and parades, quite a *spectacle*."

On behalf of the entire community, the Company officials were presented with a large bronze plaque in the lasting honor of its 100th anniversary. The plaque was received on behalf of the Company by Albert B. Wells, who after a great ovation, and words of appreciation and faith in the future of Southbridge, announced that he and his brothers, acting upon a wish and with funds provided by their father in 1911, would establish the George W. Wells Foundation, in honor of the founder of the Company. The late George W. Wells provided $100,000 to be used to perpetuate his memory, to benefit the employees of the American Optical Company and for such worthy causes as may arise. The fund, although the interest has been used from to time for charitable purposes, now amounts to $250,000, and provision is made in the terms of the Foundation to expand it to $500,000.

Thus with lasting evidences of deep mutual esteem, the community of Southbridge and its leading industry, joined in a memorable celebration of 100 years of optical craftsmanship.

Personals

Dr. James M. Shields has been promoted to associate professor of ophthalmology, and Drs. Donald H. O'Rourke and William M. Bane, to assistant professors of ophthalmology in the Medical Department of the University of Colorado.

Dr. and Mrs. E. C. Ellett, who spent August and September in Italy, Switzerland, France and England, returned home in time to attend the meeting of the American Academy of Ophthalmology and Otolaryngology in Boston. Dr. Ellett addressed the Fall Clinical Conference of the Kansas City Southwest Clinical Society, October 3, on "Recent developments in ophthalmology and ophthalmic surgery."

Dr. Morie F. Weymann has been appointed clinical professor of surgery (ophthalmology) and chairman of the department of ophthalmology and Dr. Julian Dow associate professor of surgery (ophthalmology) in the University of Southern California Medical School.